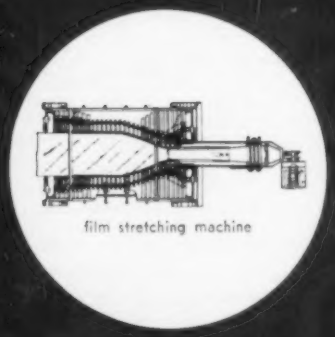
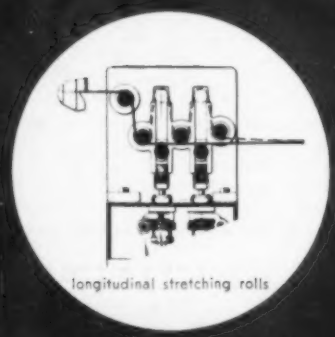
PLASTICS TECHNOLOGY

longitudinal stretching rolls


film stretching machine


longitudinal stretching rolls

University Microfilms, Inc.,
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F&E

Compression, Transfer, and Thermoforming Machines

special issue 1961

Entrance to the Plastics Division Sales Service Laboratory . . . Bartlesville, Oklahoma.

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PLASTICS TECHNOLOGY, published monthly by PLASTICS TECHNOLOGY PUBLISHING CORP., a division of BILL BROTHERS PUBLISHING CORPORATION. Office of Publications, Third and Hunting Park Avenue, Philadelphia, Pa., with Editorial Executive Offices at 630 Third Avenue, New York 17, N.Y. Subscriptions in United States and possessions and Canada $7.00 per year. All other countries $12.00. Accepted as controlled circulation publication at Philadelphia 40, Pa. Copyright 1961 by PLASTICS TECHNOLOGY PUBLISHING CORP. Please send changes of address to the New York office.

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PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

January 1961, Vol. 7, No. 1

feature articles:

relationship of surface defects to surface failures in reinforced plastics ..... p. 29
by W. J. DIAMOND
Surface quality is often the criterion for acceptance or rejection of a reinforced plastic part. Specimens with surface imperfections were studied before and after stressing and the results correlated with ultimate part failure.

economy through bulk shipment ..... p. 33
by DON B. SEMEYN
Bulk materials handling is discussed as well as the containers used for bulk shipping and methods of unloading.

technical aspects of molding acrylics ..... p. 54
by J. F. MOORE
The second half of a two-part article begun in December, this section covers some of the techniques involved in molding various formulations of Plexiglas and Implex. Gating design is discussed in some detail.

special features:

thermoforming ..... p. 37
by L. J. ZUKOR
an old process, but a new industry.

p.t's comparative data on 1961 thermoforming machines ..... p. 39

an over-all look at compression and transfer molding ..... p. 43
by L. J. ZUKOR

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p.t's classified list of auxiliary equipment for thermoforming and compression and/or transfer molding ..... p. 51

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Opinions expressed by contributors do not necessarily reflect those of our editors

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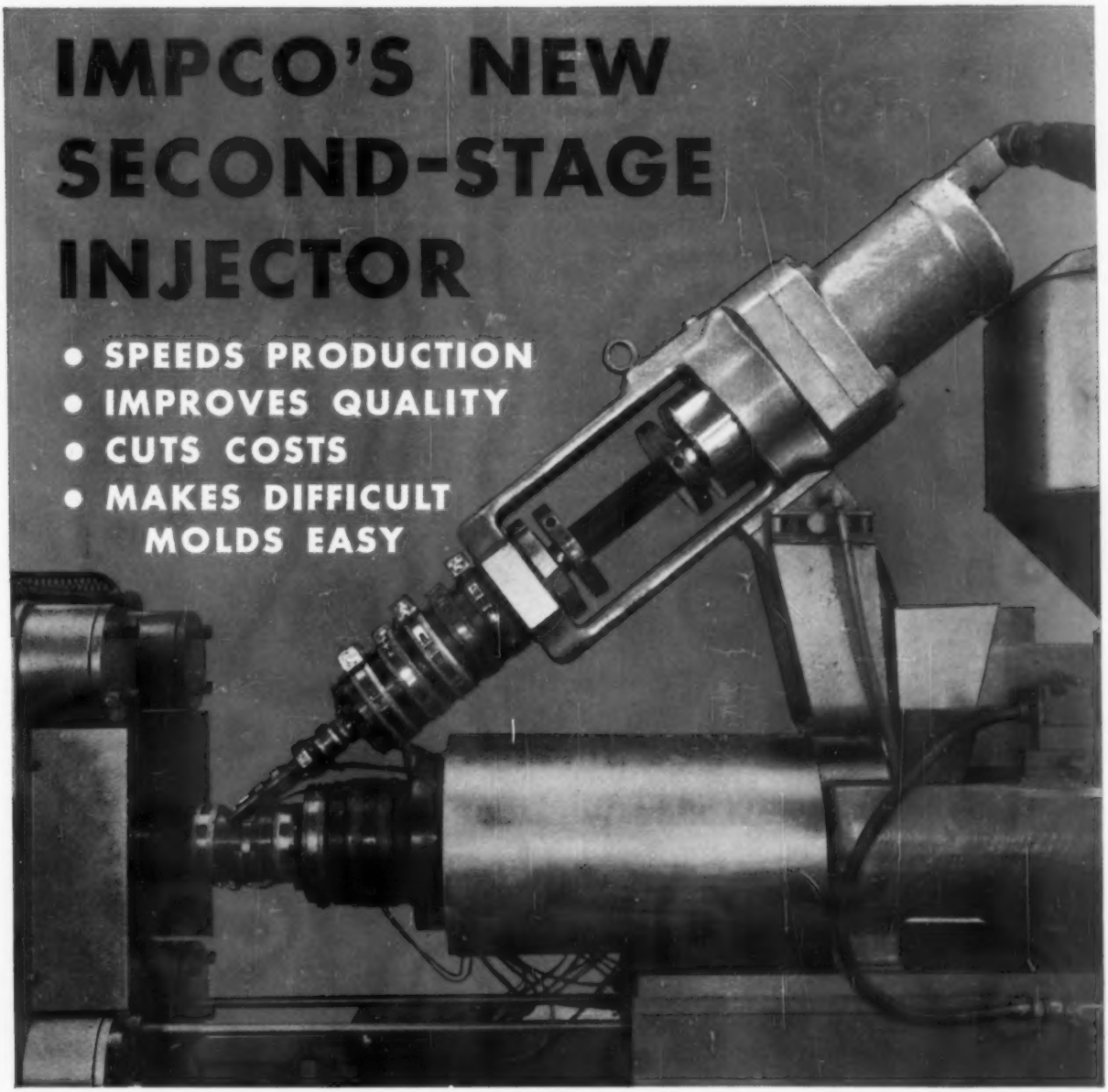

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Letters to the Editor

Cheers from the grandstand

Sirs:

Hurrah for "Markets for Flexible Foams" by P. B. Nortman—and could you send me a tear sheet of it?

Technical men do not live in a vacuum. This kind of an article performs a service for us too.

Mike Hecht
Chicago Carton Co.
Chicago, Ill.

Sirs:

Your article "Markets for Flexible Foams," by P. B. Nortman, is excellent.

I believe PLASTICS TECHNOLOGY will perform a tremendous service to the entire plastics industry if it will make the publication of articles of this caliber a regular feature in each month's issue.

The easy, non-technical approach to the market situation of products is as important to your readers, I believe, as the highly technical discussions on production opportunities and processes.

Again, thanks for a good job. I hope there will be more, and soon.

Campbell Taylor, Jr.
Columbus Coated Fabrics Corp.
Columbus, O.

Sirs:

With reference to your December 1960 issue, I, for one, appreciate the article entitled "Markets for Flexible Foams." Although the article is non-technical, it serves a real function. The function is to bring to the attention of plastics engineers the areas where new materials such as the urethane foams can be used. Too often a plastics engineer developing a new material plays with its various properties, not realizing end uses and end requirements. The development engineer cannot be divorced from the sales picture—and this article makes us aware of the sales potential.

One of our company's product lines is a foam dispensing unit. This article will help us crystallize some of our thinking as to design characteristics for better meeting the application areas on the horizon.

Keep up your foresighted efforts!

John L. Hull, Vice President
Hull-Standard Corp.

Sirs:

Your publication of "Markets for Flexible Foams" will initiate, I hope, a series of articles covering market possibilities for other materials. Articles of this sort can set the aware designer's or processor's mind working on exciting new uses of the materials with which he works.

For example, an article covering the vinyls, similar to that which discussed the urethanes, might cover applications of film, foam, sheet, and moldings in different sections. Analysis by method of processing as well as by marketers could prove exceedingly interesting.

I look forward to similar articles in the near future.

C. C. Johnson
New England Molds
Boston, Mass.

(Response to "Markets for Flexible Foams" has been most enthusiastic. Readers can look forward to similar articles. Meanwhile, for the latest innovation in urethane foam processing, which may change Mr. Nortman's predictions most favorably, see page 53, "Casting Polyurethane Chairs."—Ed.)

•

Change of address

Sirs:

Thank you for your notice of our change of address in the News of the Industry in the December issue of PLASTICS TECHNOLOGY.

Due to the wording of the notice, it might be construed that the entire company had moved. We have not moved all of our general offices from Brooklyn; only the sales offices are in Manhattan at 390 Fifth Ave. All other offices are at the plant site at 5410 Avenue U, Brooklyn.

Thanks again.

C. W. Tomlinson
J. P. Frank Chemical & Plastic Corp.

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

What to look for in February

Viscometric measurement of plastisol fusion. J. A. Greenhoe, Tech. Service, Monsanto Chemical Co., Plastics Division, Springfield, Mass.

This paper describes the Fusion Viscosity Test which measures plastisol fusion continuously while fusion is taking place. Consistency can be observed from dispersed to totally solvated state. Results are compared with the Hotbench Fusion Test, described by the author in our Octoer issue.

•

Drying polyethylene sheathing compound prior to extrusion. F. H. Kruger, Senior Engineer, Western Electric's Hawthorne Works, Chicago, Ill.

Polyethylene cable sheath containing carbon black blistered as it was emitted from the die, a condition which could be corrected by drying the compound before extrusion. This paper discusses moisture content determinations, factors affecting moisture content, obtaining the desired moisture content, and the principles of drying.

•

Infrared analysis and epoxy formulation. H. L. Lee, vp. & tech. director, Epoxylite Corp., El Monte, Calif.

An infrared spectrophotometer gives a chemical profile of epoxy formulations which can then be interpreted in terms of resultant physical and chemical properties. Desired characteristics can then be "designed in."

•

Bench molding with lightweight molds. C. L. Carlson and E. M. Halluska, Westinghouse Electric Corp., East Pittsburgh, Pa.

Aluminum alloys can be made sufficiently hard for use as molds in bench molding through the electrolytic process known as hard anodizing. Since these alloys are lightweight, the molds do not require press mounting which is both complicated and expensive. Production tests are explained.

•

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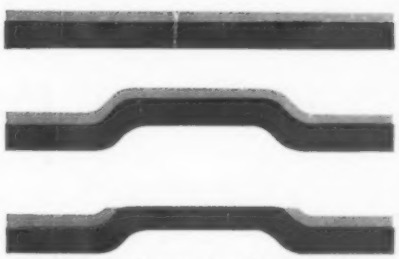
Duplex sheet is formed in the same manner as regular Butyrate sheet for signs.



Duplex Butyrate sheet consists of a single thickness with thick and thin layers of Butyrate in two different colors.

The versatility of Tenite Butyrate as a plastic material for signs gains added recognition with the development of duplex sheet. By taking advantage of the ingenious construction of this new sheet, the creative sign designer and sign builder can produce 2-color effects without use of lacquers or inks.

In essence, duplex Butyrate plastic sheet consists of a heavy layer of one color under a thin layer of a second color. The sheet is produced by extruding and laminating one layer of colored plastic directly upon another layer of a different contrasting color. For example, a duplex sheet for forming a representative 4- by 6-foot sign panel might have a heavy layer 0.090-inch thick and a thin layer 0.010-inch thick.

After the sheet has been formed into a sign panel or element, with the thin layer on the appearance side, the color of the heavy layer may be quickly exposed by sanding away the thin layer from the raised surfaces of the sign face. The choice of color combinations will be determined by the effects desired, the specific application, the use (or the non-use) of backlighting, and the esthetic preference of the individual sign designer.

For information on availability of duplex Butyrate sheet, write to the Plastics Division, Eastman Chemical Products, Inc., Kingsport, Tennessee, or to the sales office nearest you.

After forming, the thin layer of color is sanded away from certain raised areas to expose the second color underneath.

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What's new in processing

Transparent epoxy castings—flexible, high-impact, or rigid—have been made by Marblette Corp. Improved processing techniques based on special hardeners are said to account for the development. A conventionally fabricated mold is waxed and polished, given a sprayed parting coat, and allowed to dry for 10 minutes. The item to be embedded is positioned in the mold, and the low-viscosity resin-hardener mixture is poured. Cure is several hours at 180-210° F.

Laboratory Plasticware Fabricators of Kansas City, Mo., have come up with a new use for Teflon, based on its anti-sticking properties. They have developed a dispersion which is sprayed on the mold and baked at 750° F.

Continental-Diamond Fibre Corp. has been issued a patent (2,939,178) covering a process for molding sintered polytetrafluoroethylene. Compact billets, free from porosity and cracks are obtained, even when using reclaim. Superior dielectric strength properties are claimed.

Abstracts

Metallization of Plastic Materials under Molecular Vacuum by M. Mihola. Pensez Plastiques, Sept., 1960 (Special 87), describes the process and equipment for large-scale metallization at a pressure of 10^{-4}-10^{-5} mm Hg.

Contribution to the Hobbing Technique by M. Gazet, Pensez Plastiques, same issue as above, describes the hobbing technique, its applications, and possibilities. Steels suitable for hobbing and blanking are listed together with hints and precautions.

Lacquering Plastics by C. F. Spiess, Industrie Plastiques Modernes, Nov., 1960, reviews such problems as varnish composition, nature of parts treated, operating conditions, and desired effects.

Laminated Fabric Gears by H. Sollmann, Plaste u Kautschuk, Aug. & Sept., 1960, explains the fundamentals of design and describes a hobbing system for involute teeth. Sawing, turnng, boring, drilling, milling, bonding, and bolting are given along with their advantages and applications.

Coloring PTFE by Radiation Graft Polymerization by J. Dobo, A. Somogyi, and E. Lakner, Plaste u Kautschuk, Aug., 1960, suggests a dipping in vinylacetate monomer and acetate colors—followed by irradiation—to obtain coloring without sacrificing mechanical properties. Grafting is limited to the surface, using room temperatures, and penetration of color indicates distribution of graft components in the sheet.

Patents

2,895,173 to United Aircraft Corp., East Hartford, Conn.—Method of Centrifugally Forming Arch-Walled Reinforced Plastic Tubing.

2,894,621 to Alysnite Co. of America—Process for Making Reinforced Plastic Panels.

2,894,285 to Owens-Illinois Glass Co.—Gob Feeding of Organic Plastic Materials.

2,896,262 to Kalle & Co., Wiesbaden-Biebrich, Germany—Process for Transversely Stretching Thermoplastic Sheet.

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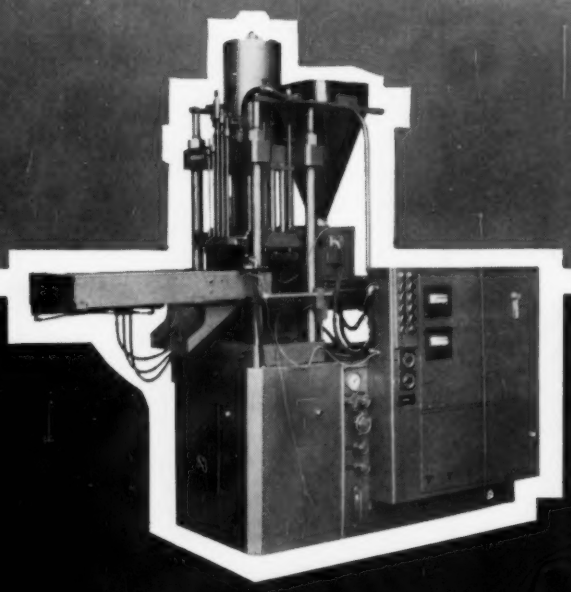

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This bulletin describes the use of newly-developed materials in maintenance applications. These applications will be of interest to anyone dealing with corrosion problems—whether they are actually using coating products or marketing them.

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address your request to any Oronite office.

Note: This bulletin is a revised up-to-date edition of the original Maintenance Bulletin issued July 1959.

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Editorial:

JANUARY, 1961

Is the honeymoon over?

Every year about this time you and I are deluged with year-end reports and predictions for the future. They range all the way from "blue-sky" reports of break-throughs in sewer-pipe technology to grim forecasts of the destruction of our entire economic system.

Happily, most predictions for the plastics industry have been much more realistic — a cautious optimism, with industry gains dropping from the customary 11-12% annually to a more modest 5%. Plastics are beginning to replace plastics, the same way they used to replace wood and metals.

Is this bad? Not to the industry as a whole, but certain segments are beginning to feel the bite. It bears out what we said before, that if a plastics processor does not want to become a Dun & Bradstreet statistic, he must have the latest information on materials, process equipment, and market potentials.

Without being unduly pessimistic, many of us are disturbed by what's happening with vinyls, specifically PVC. Here's a material, number two in sales, which is being overproduced by nearly ½-billion pounds annually. The ideal solution is obvious — find new markets.

But how are new markets found? Almost invariably through research, and this takes money! Overproduction has brought the price down to an official 18½¢ per pound, unofficially nearer 16¢. What's the next cut? Research and technical service.

Who or what's to blame? Many say that the price was held around 40¢ much too long. Monomer price dropped (now around 8-9¢ delivered), why not polymer? The profit picture attracted many small operators with no research or other expenses who could sell on price alone. Other materials, notably polyethylene and polypropylene, profited — at the expense of vinyl. Those interested in the fast buck couldn't care less.

Outlook bleak? Not necessarily, but look for the price to become stabilized around 21¢. This will allow for more product development work. With luck, we won't have the metals shortage which turned Europe and Japan to vinyls, but there are other outlets. Blow molding of vinyl is a negligible market as of now, but it doesn't have to be. Alloys of chlorinated polyethylene and vinyl could account for considerable sales.

We need closer cooperation between supplier and processor, not suspicion and antagonism. There have been few worthwhile papers on vinyl of late. Calendering accounts for 1/3 of all vinyl consumption, but nothing has been said in years on such aspects as material lay-up, gage uniformity, and residual shrinkage. Look for more vinyl articles in 1961 — but worthwhile ones!

Jim Dugan

Editor

U.S.I. POLYETHYLENE NEWS

A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

JANUARY, 1961 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Disposable aprons of polyethylene-coated perforated and embossed paper were tested in the galleys of a rig by an offshore oil drill company to determine their utility. The aprons are said to protect against grease spatterings, and withstand the normal soiling encountered in meal preparation. The expense of handling and transporting soiled cloth aprons back to the mainland and laundry costs are eliminated by the disposable apron.

Storage drums of conventional polyethylene, accepted by FDA for use with foods, can now be obtained in 20-, 32- and 55-gallon sizes with or without dust covers. Air-tight polyethylene covers and steel closure rings are available for the 55-gallon size, also.

According to the manufacturer, drums are clean, white, lightweight and quiet; have excellent impact resistance; nest for storage; will handle most jobs of stainless steel drums, yet cost less. Other applications include storing supplies, emergency water, sterile linens and clothing, and chemicals.

One-Gallon Jug fabricated of conventional polyethylene has pouring spout set off-center to allow a large carrying handle on top. A tail on the handle permits using the little finger to get a tighter hold.

According to the producer, this redesigned jug, which is the same price as a previous model made by the company, has a stronger spout and body and is more stable. Closures are claimed to be skip-proof and leak-proof.

New end label for polyethylene bread wrap claimed to have exceptional adhesive qualities requires only moderate heat for positive closure. The coating is activated at approximately 150° F. which is 40° lower than the temperature needed by most other heat-activated end labels. (The heat from a cigarette is said to be sufficient.) This quick-melt coating eliminates melted or pinhole burned polyethylene.

U.S.I. Sees Usage of Polyethylene Up 10 Per Cent In 1961

Increases Anticipated in Many Market Areas

"In 1961, polyethylene will regain much of the sales momentum that characterized its dynamic growth in the late 1950's," forecasts Vincent D. McCarthy, Director of Plastic Sales of the U.S. Industrial Chemicals Co.

Polyethylene film will be a leading factor in increasing polyethylene usage by 10% in 1961, according to Vincent D. McCarthy, U.S.I.'s Director of Plastics Sales.

U.S.I., manufacturer of PETROTHENE resins, is the world's second largest producer of polyethylene.

Mr. McCarthy predicts a rise in usage approaching 10% for 1961, indicating that a number of fast-growing markets will make it possible.

The demand for film and sheeting of conventional polyethylene, for example, is expected to increase to 465 million lbs. in 1961 compared with the 400 million lbs. used last year. Spurred by wider use of inplant automatic polyethylene packaging equipment, this material has made steady inroads in breadwrap, produce, textile, and other fields. Automatic equipment in use is typified by the See-Safe machine, with which even outsize products such as card tables and bolts of cloth can be custom-packaged efficiently in polyethylene.

Additional conventional polyethylene, perhaps as much as 75 million lbs., can be expected to go into coating this year. Polyethylene coated milk cartons will lead the growth in the fast moving extrusion coating fields.

Blow Molding To Gain

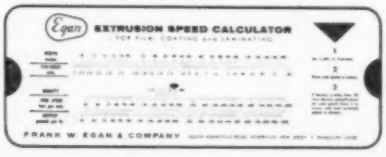
According to Mr. McCarthy, blow molding, now a 50-million lbs.-per-year market, will climb faster in '61 and eventually rank with injection molding (now consuming 250 million lbs. of conventional polyethylene yearly). He sees a shift developing from low-density to medium-density polyethylene in this field, but feels the 1961 sales upturn will be shared by linear polyethylene.

Pipe and wire and cable insulation are among other markets for conventional polyethylene which are each expected to contribute an increase of about 5% in usage to the '61 sales picture.

Sports Megaphones Injection Molded Of Polyethylene

Megaphones for sports fans are being injection molded of a U.S.I. PETROTHENE polyethylene resin by an Ohio firm. According to the company, PETROTHENE 208 resin was chosen because of its uniformity, and because it provides good gloss and durability, flows better than competitive materials, and gives better than average results with dry coloring.

Available in a variety of colors with contrasting hot-stamped collegiate emblems, the megaphones are reported to withstand constant squeezing and handling and a wide range of weather conditions.



Free Slide Chart Offered

A handy extrusion speed calculator for film, coating and laminating is available from a manufacturer of extrusion coaters. With this slide rule, the extrusion capacity required for a specific web speed, width and coating thickness can be quickly determined.

U.S.I.

Series VI, No. 1

POLYETHYLENE PROCESSING TIPS

HOW TO DETERMINE OPTIMUM BLOW-UP RATIO

In blown film extrusion, blow-up ratio is the ratio of the diameter of the film "bubble" to the diameter of the extruder die. It's much easier to measure the width of the lay-flat tube after it has passed through the nip rolls than the diameter of the inflated bubble. And since the two are related by simple geometry, blow-up ratio can be calculated easily from the formula:

$$\text{Blow-up ratio} = 0.637 \times \frac{\text{lay-flat width}}{\text{die diameter}}$$

The best possible balance of film properties for a given polyethylene resin can be obtained with a 2:1 to 2.5:1 blow-up ratio. This recommendation is based on studies at U.S.I.'s Polymer Service Laboratories, combined with field experience of U.S.I.'s Technical Service Engineers.

Effect on Specific Film Properties

In the U.S.I. studies, six general-purpose film-grade polyethylene resins were extruded under comparable conditions at blow-up ratios of 1:1, 1.5:1, 2:1, 2.5:1, 3:1, and 3.5:1. The properties of these resins varied over a rather wide range. Yet, as blow-up ratio was increased, the effect on specific properties was similar for all six resins:

Transmittance increased 12 to 16 units (Fig. 1). PETROTHENE® 112, for example, had a 60% transmittance at 1:1 blow-up ratio and 72% transmittance at 3.5:1.

Gloss, measured at a 60° angle, increased 1.2 to 2.5 units (Fig. 2). The average was 7.1% at 1:1 blow-up ratio and 9.3% at 3:1.

Haze decreased significantly (Fig. 3). Average decrease was 3.5 to 4.5 units.

Impact strength improved (Fig. 4).

FIGURE 1

FIGURE 2

While these tests seem to indicate 3:1 or higher as an optimum blow-up ratio, this is not the case. Note how other essential properties are affected by an increase in blow-up ratio:

Straight line tear, the tendency of film to tear in a straight line, is reduced significantly.

Elmendorf tear strength decreases significantly above a 2:1 blow-up ratio.

Yield strength decreases slightly.

Break point increases in the transverse direction and decreases in the machine direction.

Tendency to wrinkle may be a serious problem above a 2.5:1 blow-up ratio.

How To Increase Blow-Up Ratio

Because film lay-flat width is almost always predetermined, blow-up ratio is ordinarily increased by using a smaller die diameter. True, this results in a slight decrease in output; however, increasing screw speed will usually compensate for most of this decrease.

What Blow-Up Ratio Should You Use?

Extruders now producing blown film at a blow-up ratio below 2:1 should consider increasing it if they desire improved optical properties and higher impact strength. Also, companies entering the field should consider blow-up ratio before deciding which size dies to buy.

Of course, other factors may be involved. If you have questions on specific problems, we suggest you seek advice from U.S.I. Technical Service Engineers.

FIGURE 3

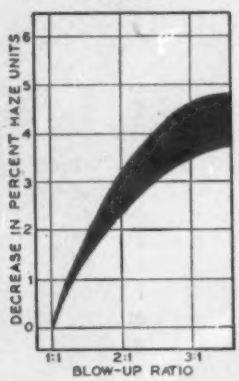
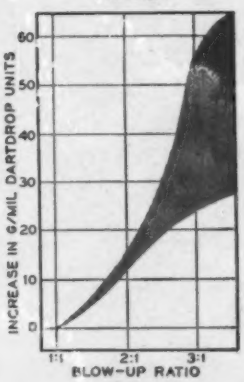
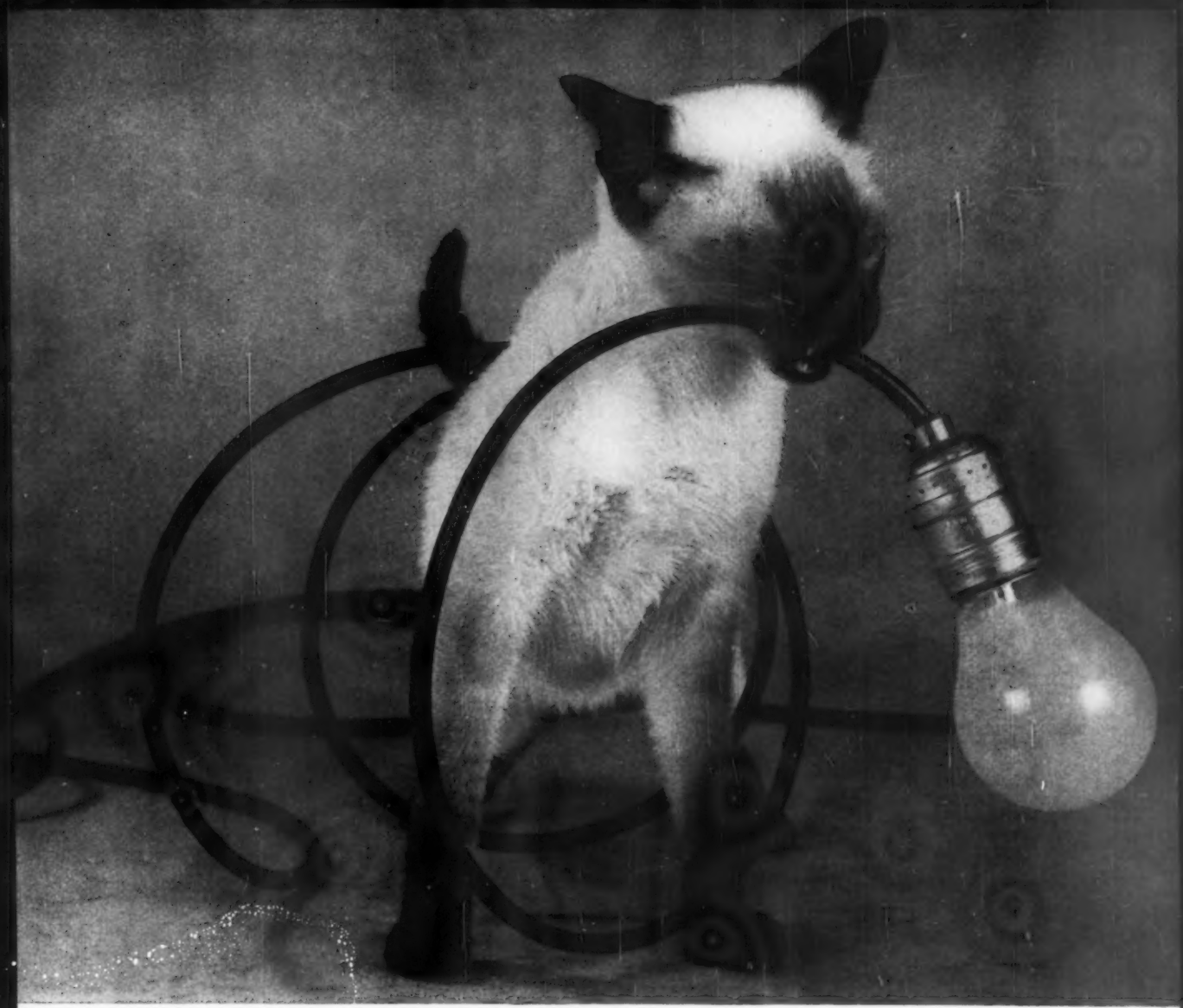


FIGURE 4



U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



Stabilization of Electrical Compounds?

The answer to superior electrical insulation—at low volume cost—is the new Argus stabilizer, Mark AMP. It has lower specific gravity than lead stabilizers. Thus, by volume, it costs *less.*

Mark AMP gives excellent resistivity and retains physical properties upon high temperature heat aging. It assures excellent retention of capacitance, resistivity, and % power factor upon extended aging in water at 70°C. In addition, it can be used in a wide range of insulations.

Whether you're looking for better ways to stabilize electrical compounds, clear rigids, *any* vinyls—or ways to invest vinyls with non-toxic, low temperature or other specific properties—you'll find it pays to check with Argus.

If one of our line Mark stabilizers or Drapex plasticizers doesn't solve your problems, our research chemists *will.* Call us!

Argus Has the Answer

Technical bulletins and samples on request

ARGUS CHEMICAL Corporation 633 Court Street, Brooklyn 31, N.Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 11911 Woodruff Ave., Downey, Cal.; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal. European Affiliates: SA Argus Chemical NV; 33, Rue d'Anderlecht, Drogenbos, Belgium – Lankro Chemicals, Ltd.; Salters Lane, Eccles, Manchester, England.

NOW Controlled Tension From Start To Finish In Winding Roll-Fed Material

Never Before Anything So Efficient • Simple • Versatile

This is your chance to obtain a higher quality of wound material than ever before — and to save substantially on operating and maintenance costs at the same time.

You've never seen anything like the Hobbs "CHP" Winder. It's in a class by itself. No other winding device can match it for simplicity, efficiency and flexibility.

OPERATES ON A.C. Here is a squirrel cage three-phase A.C. motor, flange mounted to a gear reducer. It can be connected *directly* to your rewind shaft. It is entirely independent of the main machine drive. You plug it into your present three-phase power outlet — no transformers or converters to bother with. Then you set a knob to the desired tension and walk away.

AUTOMATICALLY SENSES TORQUE. From the start to the very finish of your rewind operation, the "CHP" accurately maintains the desired tension — protects even the most delicate materials from stretching, breaking or contracting. Automatically the "CHP" senses the increase in torque as the roll diameter builds up and it slows down the speed of the shaft in direct proportion. Controlled tension can be maintained in a roll build-up of as high as 10 to 1.

ECONOMICAL, FLEXIBLE. The efficiency of the "CHP" is many times greater than that of other types of winders. Maintenance is as slight as with any normal A.C. motor — there are no brushes or tubes. The "CHP" is compact, saves you floor space. It is clean, there are no belts to slip and stir up dirt. It is flexible — connect it directly to the rewind shaft, or remotely by chain and sprockets. And it needs no supervision, saves you labor costs.

MULTIPLE APPLICATIONS. The "CHP" Winder has already proved its adaptability and efficiency in multiple applications: — for winding, unwinding and inspection of paper, plastics, rubber and woven and non-woven textiles in a wide range of widths and weights.

Find out for yourself just why the Hobbs "CHP" Winder can make such a big difference — how it can give you increased production through *positive* quality control. Mail coupon below for free information. No obligation.

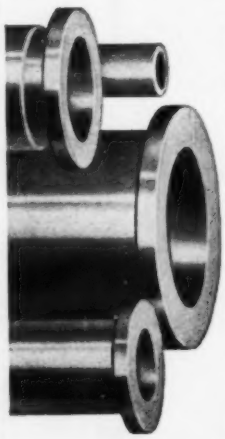
HOBBS MANUFACTURING CO.
78A Salisbury St., Worcester 5, Mass.

Kindly send complete information on the new Hobbs "CHP" Winder.

Name ..... *Title* .....
Company .....
Street .....
City ..... *Zone* ..... *State* .....

only Xaloy

meets every requirement in extruder cylinders



1... **because** Xaloy *bimetallic cylinders* are available in *all* sizes, engineered to meet the individual requirements of plastics and rubber processors.

2... **because** the mirror-smooth surface of Xaloy liners allows maximum production, hour after hour, in continuous service.

3... **because** Xaloy cylinders have proven to be the most advanced liners for extrusion machines over the past 25 years.

WRITE FOR NEW XALOY DATA GUIDE

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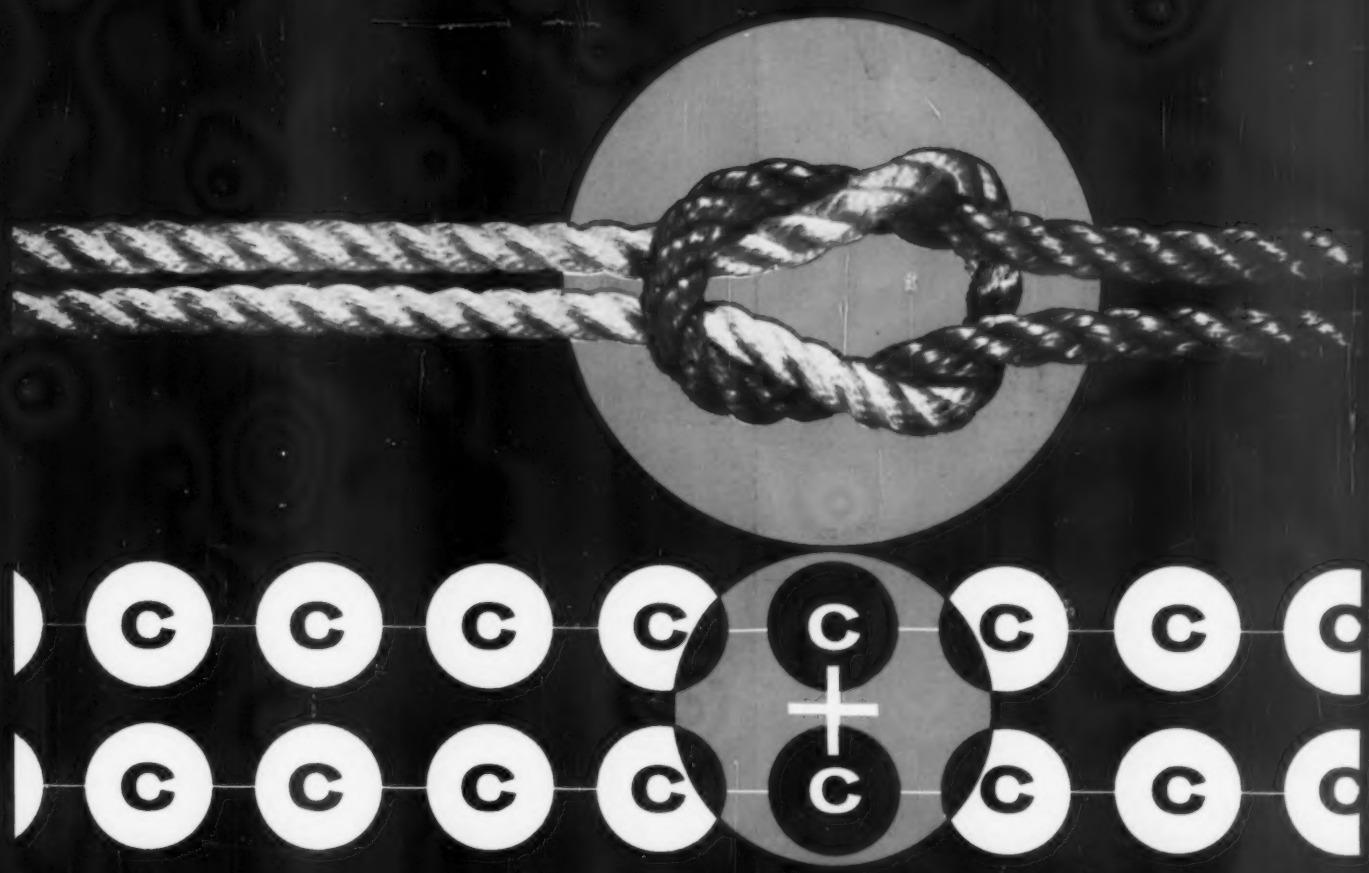
Division of Honolulu Oil Corp.
961 East Slauson Ave.
Los Angeles 11, Calif.



DI-CUP® . . . *The Chemical Way to Cross-Link Polyethylene*

Di-cup, Hercules dicumyl peroxide, is a source of free radicals, which are highly effective in chemical cross-linking. It provides a simple, economical, and practical means of cross-linking low-density polyethylene.

Cross-linked polyethylene is a thermoset material resistant to softening and deformation at high temperatures. It shows no evidence of environmental stress cracking and it is resistant to many solvents at high temperatures.

This development opens new markets for products that require superior toughness, flexibility, impact strength, and chemical resistance.

For more information on Di-cup, write

Oxychemicals Division
Naval Stores Department
HERCULES POWDER COMPANY
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900 Market Street, Wilmington 99, Delaware

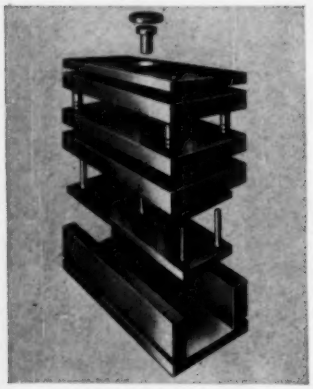
N060-2

3 WAY SAVINGS

WITH D-M-E STANDARD MOLD BASES

1 ADDED QUALITY

Exclusive design features provide extra-cost construction at standard prices! You get first-quality carbon or alloy steel, all surfaces ground flat and square, plus these features offered only by D-M-E: Patented tubular dowel construction; one-piece ejector housing; stop pins welded to ejector bar; sizes to 23¾" x 35½"; and the assurance that every D-M-E product is inspected *by the most modern methods and equipment.*

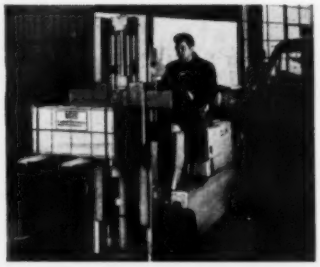


2 GREATER ECONOMY

Interchangeability lets you replace *any* component without special fitting or re-working! What's more, you can select from the widest range of Standard Mold Bases available anywhere—over 7,000 cataloged combinations.

3 FASTER SERVICE

Delivery from local stock means you get Standard Mold Bases, components and moldmakers' supplies when you need them —direct from D-M-E's fully-stocked local branches!



ARE YOU GETTING THE NEWS?

D-M-E's monthly publication is full of cost-saving ideas for designers, moldmakers and molders. Write on your letterhead—we'll place your name on the "NEWS" mailing list. No cost, no obligation.

DETROIT MOLD ENGINEERING COMPANY

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New Quality Standard of the INDUSTRIAL THERMOPLASTICS

credentials:

Property	*ASTM No.*		*Value**
Impact strength, Izod (notched)	D-256	(½" x ½")	2 to 3 ft-lb/in.
		(½" x ⅛")	12 to 16 ft-lb/in.
Elongation, at yield	D-638		5-6%
Elongation, ultimate	D-638		60-100%
Deformation under load	D-621		0.14%
Flexural strength	D-790		11,000-13,000 psi
Dissipation factor	D-150		
60 cycles			0.0007
10^6 cycles			0.0100
Heat distortion	D-648		
264 psi			280°F
66 psi			290°F
Flammability (in./min.)	D-635		Self-extinguishing
Clarity			Transparent
Water absorption 24 hr. immersion	D-570		0.15%

*These values have been obtained under standard ASTM and laboratory test conditions. As averages, they do not necessarily represent minimum material specifications.

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Further application data and property tables (based on more than five years of research and development work here and abroad) are available. Write to the Mobay Products Company, Dept. 610, Pittsburgh 5, Pennsylvania. M-1

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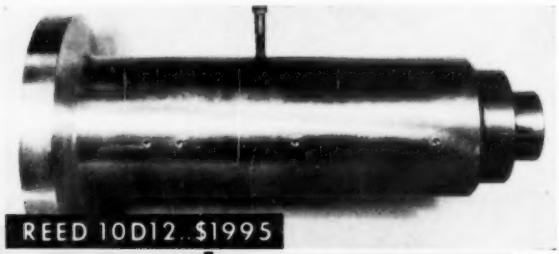
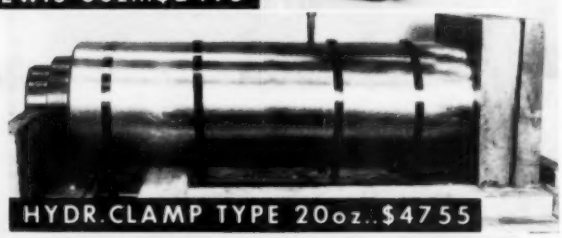
Your Heating Cylinder PROBLEMS Are Our Business!



REED 10D12..$1995

LEWIS 6oz...$2495



HYDR.CLAMP TYPE 20oz..$4755

VAN DORN 2½oz...$1155

REED 10D8..$1495

No matter what your make of injection press!

Yes, it's true! We don't even have a product unless you have an injection molding problem! IMS Replacement Cylinders are quickly made to special order...often much faster than older model replacements can be obtained from the original pressmaker.

Unless you replace with an IMS Long Life Heater, you may just be buying your old troubles all over again! When you specify an IMS Replacement Cylinder, you cut your heats...reduce your repair costs and often pick up enough extra cycle time to pay for the IMS Chamber in just a few months operation.

What's more, we find your cylinder troubles tend to come in rashes, so we often build extra cylinders for stock. Whenever you have a press down because of heating cylinder trouble, phone for the IMS Stock Heater List...your next heater may be in our shipping room right now!

IMS

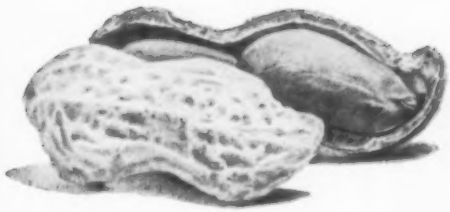
REPLACEMENT HEATING CYLINDERS

When you have heater trouble, call IMS. We keep many stock cylinders like the above on hand for immediate shipment!

INJECTION MOLDERS SUPPLY CO., INC.

17601 SOUTH MILES ROAD • CLEVELAND 28, OHIO • LUdlow 1-3200

Nature provides safe...



...nontoxic protection...

...and so can you in...

...your packaging product.

plasticize with

PFIZER CITROFLEX® A-4

(accepted by the F.D.A.)

Be sure the plasticizer you use in food-wrap products is safe beyond all doubt. Specify Pfizer CITROFLEX A-4 (Acetyl Tributyl Citrate), the product of choice for use in plastic coatings, packaging films and plastisols. It is nontoxic, odorless, economical. It has been accepted by the Food and Drug Administration for use in the manufacture of packaging for both fatty and non-fatty food products. Look to Pfizer first for safe, economical plasticizers. Why not investigate Pfizer's complete line of nontoxic plasticizers? Write for Technical Bulletin #31, "Citroflex Plasticizers." Chas. Pfizer & Co., Inc., Chemical Div., Brooklyn 6, N. Y.

Science for the world's well being

Pfizer

CHEMICAL DIVISION

Joe Foster, President, discusses bulk handling's value to Foster Grant customers.

"Here's why a leading molder now buys Fosta® Tuf-Flex in bulk," says Joe Foster

The reason—impressive over-all cost savings.

Sperzel Company, a major manufacturer of plastic containers and plumbing fixtures, saves 1¼ cents per pound by bulk purchases of our polystyrene. Fosta®Tuf-Flex is delivered in sealed "Dri-Flo" cars instead of in the customary 50-pound bags.

Also, Sperzel's bulk-handling system—engineered by Foster Grant and patterned after the one we developed for our *own* operations—saves them another two to three cents per pound in handling costs. The Fosta®Tuf-Flex is blown by special cyclones from the cars into six 150,000-pound-capacity outdoor storage silos—which free some 40,000 square feet of in-plant space. From there, it's pumped into the molding and extruding machines.

The system is expected to pay for itself in less than 18 months. Other advantages: friction in the pipes keeps the resin dry; increased capacity has opened new markets for the Sperzel Company.

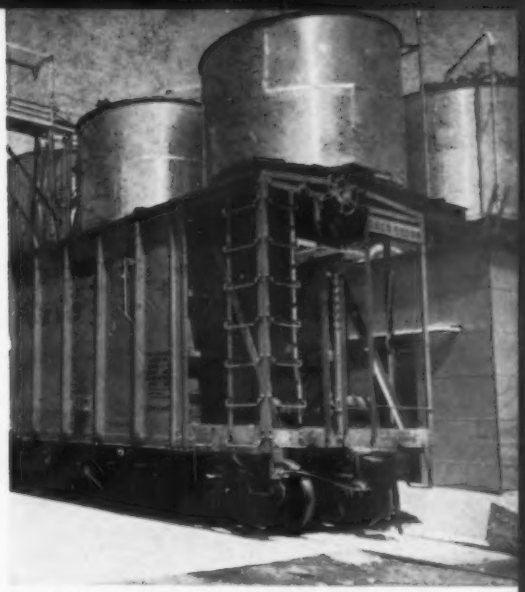
If *you* use at least 200,000 pounds of resin a month, you should be considering bulk handling now. And when you start evaluating bulk handling, take advantage of our experience. We'll be glad to counsel with you, and even demonstrate how you can profit from a temporary set-up while your permanent system is being installed.

Call us today, at KEystone 4-6511. Or write Foster Grant Company, Inc., Leominster, Mass.

Your Partner in Plastics Progress

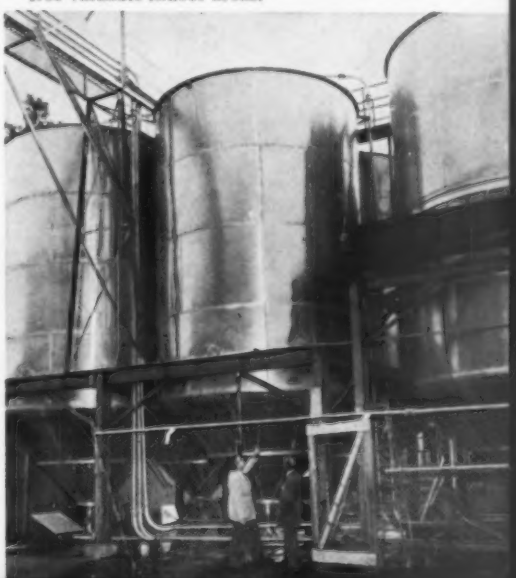
FG FOSTER GRANT

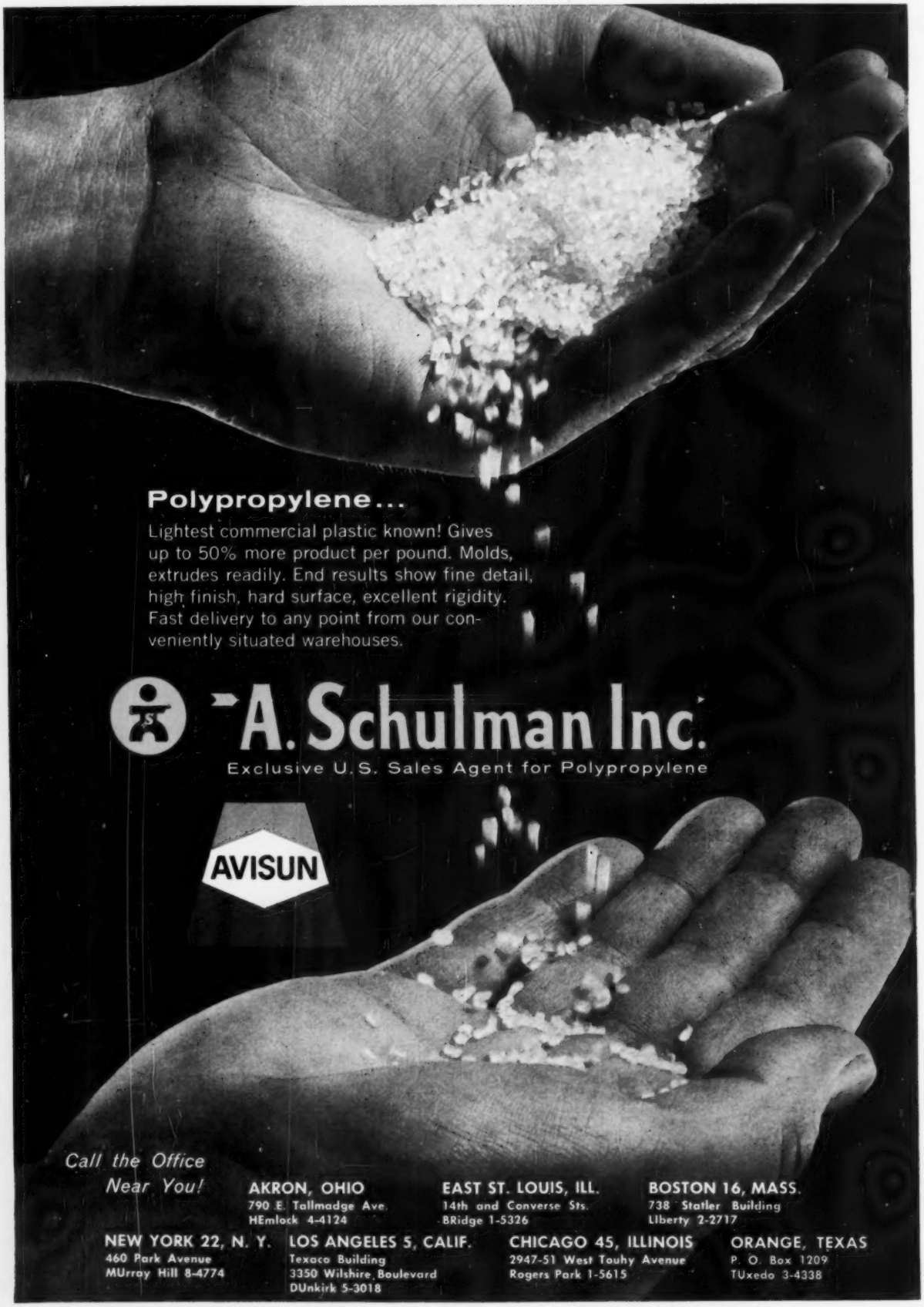
Plants in Leominster, Mass., Manchester, N. H., Baton Rouge, La.
Branch Offices and Warehouses in Principal Cities
Also distributed by H. Muehlstein & Co., Inc., New York, N. Y.



ABOVE: *Saves on resin cost.* Tuf-Flex in bulk costs 1¼ cents less a pound than in multiwall bags.

ABOVE: *Saves on handling costs.* Resin goes from cars to silos to molding machines—automatically.
BELOW: *Saves plant space.* Outdoor storage silos free valuable indoor areas.




Polypropylene...
Lightest commercial plastic known! Gives up to 50% more product per pound. Molds, extrudes readily. End results show fine detail, high finish, hard surface, excellent rigidity. Fast delivery to any point from our conveniently situated warehouses.
A. Schulman Inc.
Exclusive U.S. Sales Agent for Polypropylene
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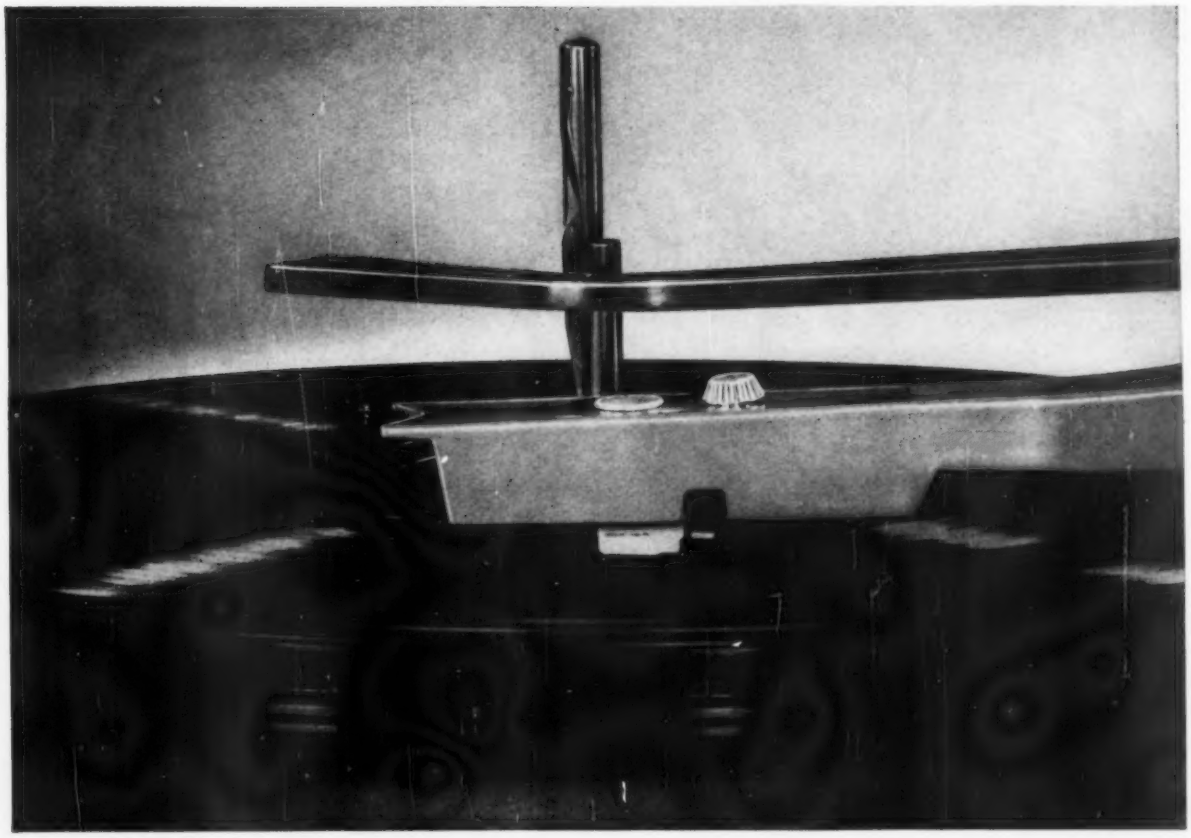
BOSTON 16, MASS.
738 Statler Building
LIberty 2-2717
NEW YORK 22, N. Y.
460 Park Avenue
MUrray Hill 8-4774
LOS ANGELES 5, CALIF.
Texaco Building
3350 Wilshire Boulevard
DUnkirk 5-3018
CHICAGO 45, ILLINOIS
2947-51 West Touhy Avenue
Rogers Park 1-5615
ORANGE, TEXAS
P. O. Box 1209
TUxedo 3-4338



For records...

Let LECTRO® 78 stabilizer help you maintain maximum physical properties with vinyl resins

LECTRO® 78 is a basic lead stabilizer developed for use with all types of vinyl chloride polymers.

Manufacturers of both filled and unfilled vinyl phonograph records find Lectro 78 an outstanding stabilizer.

Its high heat stability maintains the maximum physical properties attainable with vinyl resins. As a result, their records have superior wear properties . . . highest fidelity . . . lowest noise level. And because of the compatibility and good stabilizing action of Lectro 78, there's no annoying problem of surface streaking.

Besides phonograph records, there are many other applications where Lectro 78 can simplify production, improve performance. This stabilizer is exceptionally well suited for high temperature insulation, rigids and other compounds. Its easy dispersion and non-gassing characteristics combine to make this stabilizer an excellent choice to help you meet a variety of severe processing and service conditions.

For example . . . in tests made according to Underwriters' Laboratory procedures on T, TW, 90°C and 105°C coated wire, Lectro 78 displays high volume resistivity over a range of temperatures. What's more, it shows outstanding moisture resistance.

And that's not all. Lectro 78 stabilizer is an efficient basic lead vulcanizing agent for chlorosulfonated polyethylene... has good compatibility with most plasticizers commonly used in electrical insulation . . . requires less lubricant than most other electrical stabilizers. Use the convenient coupon below to get valuable additional information on Lectro 78 stabilizer. A data sheet can be yours by return mail.

LECTRO® 78 *A Chemical Development of*

National Lead Company

111 Broadway, New York 6, N. Y.

KC-6294

NLC

National Lead Company: General Offices, 111 Broadway, New York 6, N.Y.
In Canada: 1401 McGill College Avenue, Montreal.

Gentlemen: Please send your new Data Sheet for LECTRO® 78, basic lead stabilizer for use with all types of vinyl chloride polymers.

Name _____ Title _____

Company _____

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HOW TO "BUILD IN" HIGH RESISTANCE TO FIRE AND CHEMICALS WITH LOW-COST AROCLOR® PLASTICIZERS AND RESIN EXTENDERS

AROCLOR *chlorinated* polyphenyls—liquid or solid—offer remarkable *inertness*. They don't burn, evaporate, hydrolyze, or oxidize. They defy strong acids and alkalies. They blend readily with nearly all resins, solvents, plasticizers, and other plastics-compounding ingredients. You can choose from 13 standard AROCLORS—to impart outstanding flame retardance, chemical resistance, and other desired properties to your plastics compounds and protective coatings . . . *at low cost.*

NONBURNING EPOXIES

Aroclors are fully compatible with epoxy resins. Combined with a small amount of antimony oxide, they produce *nonburning* compositions. Aroclor 5460 yields epoxies with optimum compressive strength. Aroclor 1221 greatly improves flexibility.

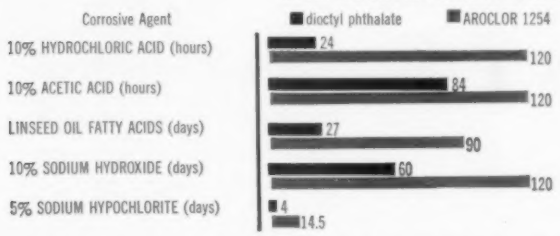
	AMINE-CURED EPOXIES		PHTHALIC ANHYDRIDE-CURED EPOXIES	
formulation	**control**	**modified**	**control**	**modified**
liquid epoxy resin	100	100	100	100
diethylenetriamine	13	13	...	...
phthalic anhydride	...	...	75	75
antimony oxide	...	5	...	5
DMP 30 (Rohm & Haas)	...	...	0.1	0.1
AROCLOR 1260	...	15	...	...
AROCLOR 5460	...	...	...	15
properties				
compressive strength, *psi*	43,000	38,150	23,400	40,700
flexural strength, *psi*	20,100	22,100	16,900	19,000
heat distortion, °C.	117.5	92	143	135
FLAMMABILITY— *inches per minute* (ASTM D635-56T)	0.82	NON-BURNING	0.6	NON-BURNING

EXTENDERS FOR PVC

Aroclors are especially effective as secondary plasticizers or extenders for polyvinyl chloride. Aroclor 1262, used 1:3 with dioctyl phthalate, sharply reduces migration to nitrocellulose lacquers. All Aroclor compounds can be used to improve the chemical resistance of vinyl chloride–vinyl acetate coating formulations.

TYPICAL CHEMICAL RESISTANCE*

vinyl chloride/vinyl acetate copolymer; plasticizer concentration: 25%



Plotted from independent evaluation data by the Northwestern Paint and Varnish Production Club** (The Official Digest, Nov. 1955). Conclusion: **"The Aroclor 1254 had the best all-around chemical resistance."

SELF-EXTINGUISHING POLYETHYLENE

Aroclor 5460 gives self-extinguishing, low-density polyethylene *with minimum effect on tensile strength or "memory."* Aroclor 5460 substantially improves heat stability, too, compared with other common flame retardants.

LOW-DENSITY POLYETHYLENE

formulation	**control**	**modified**
polyethylene	100	70
antimony oxide	....	10
AROCLOR 5460	....	20
properties		
melt index	1.96	6.2
% elongation	655	650
tensile strength, *psi*	2130	1710
yield strength, *psi*	1395	1300
FLAMMABILITY— *inches per minute*	7.1	SELF-EXTINGUISHING

NEW BOOKLET gives the facts about "Aroclor Plasticizers"... **compounding procedures, performance data, property tables, specific formulas.** It tells how versatile AROCLORS could be **your** answer for better compounds at lower cost. Mail the coupon today

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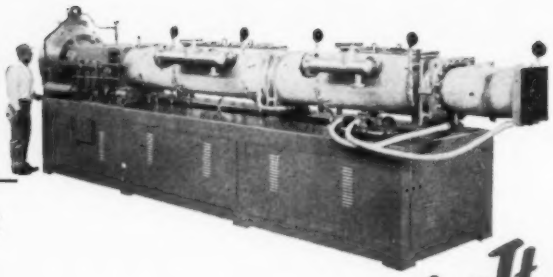

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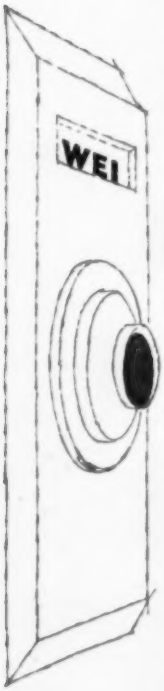

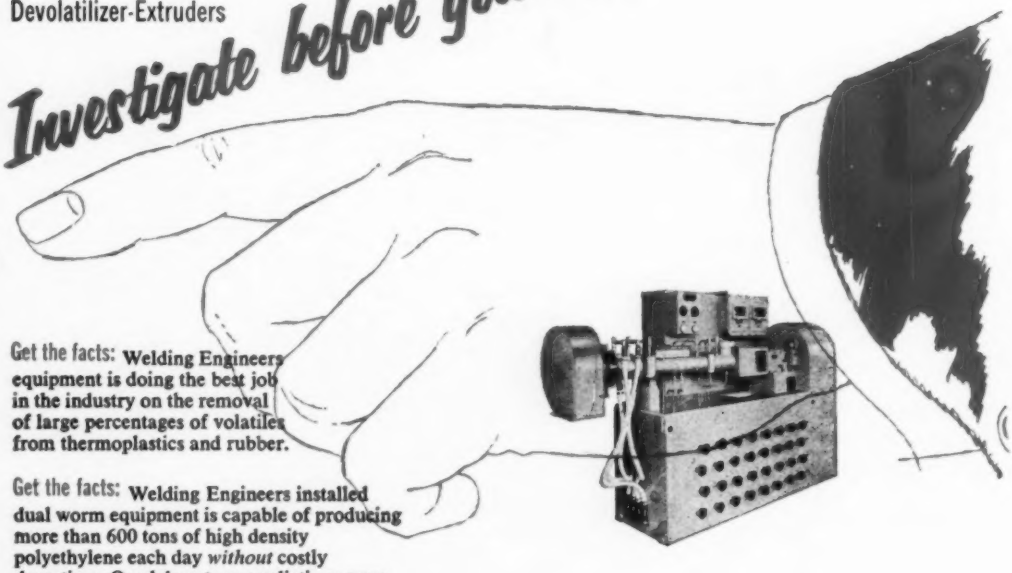

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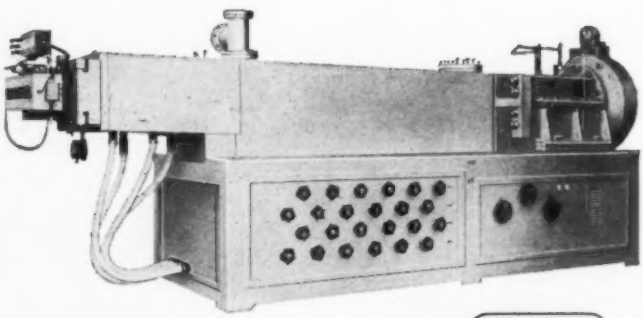

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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

Relationship of surface defects to surface failures in reinforced plastics

Results of a microscopic study of specimens before and after stressing

W. J. DIAMOND*

Fiberglass-reinforced polyester moldings offer many excellent qualities in both industrial and commercial products. Growth of the industry, however, has been retarded by such factors as production difficulties, high reject rates, high cost, low production rates, and poor field performance. On analysis, many of these deficiencies can be attributed to a common culprit—inadequate surface.

A great majority of rejects are caused by air bubbles on, or just under the surface; cracked or crazed surfaces; fiber prominence at the surface; inadequate wetting of surface fibers; foreign material in surfaces; resin rich surface areas; and pre-gelation discontinuities. Repair of defective surfaces and/or finishing the part with organic coatings add to already high costs. Appearance degradation (crazing, abrasion damage, and excessive soiling) is often the reason for field complaints.

Elimination of surface problems in reinforced plastics would result in substantial cost reduction, product improvement, and increased applicability to many product lines. Yet, a literature survey reveals that either very little work had been done on the problem, or no significant results had been obtained. It was replete, however, with information that indirectly applied to the problem.

Our program for improving the surface of fiberglass-reinforced polyesters evolved from the following basic premises:

1.—Research was required before development could commence. We define research as the collection of many facts about a material and/or process, and the subsequent integration of these facts into a consistent explanation of the probable origin and implication of the phenomena. Development is the utilization of research finding to obtain a better or less expensive product.

2.—Microscopic examination of molded surfaces before and after stressing would reveal fundamental rather than superficial causes of poor quality surfaces.

3.—Laboratory and product testing techniques would have to be developed and correlated with fundamental surface phenomona. It was hoped that modification of available techniques would be adequate.

4.—A concerted effort was required. Brunswick's research, development, and engineering departments would work closely with the comparable groups from resin, glass, and filler suppliers.

5.—Extensive use would be made of the literature and the experience of technical personnel on the project. However, such information would be suspect until experimentally verified under controlled conditions.

This paper describes the surface phenomena observed in our microscopic studies, and the relationship between these and surface failures—primarily, soiling and crazing. The work of Smith and Lowry (2)* guided our initial effort. They proved conclusively that bubbles in cured resin were due to air entrapment. Figures 1-5 show the various surface manifestations of this trapped air which were observed in our experiments. All photo micrographs are magnified 250X.

Figure 1 shows several fibers close to the surface, completely surrounded by an air pocket. These pockets have been observed with widths as much as ten times that of the glass filaments and as much as one inch long. In the case of single fibers, frequent constrictions in the diameter of the air pockets are the only contact between fiber and resin. The thickness of resin over the air pocket has been estimated as less than one fiber diameter and is sometimes cracked even before stressing.

Figures 2 and 3 show a very prevalent surface defect —minute air bubbles which have been placed in a

* Brunswick Corp., Muskegon, Michigan

* Numbers in parentheses refer to Bibliography at end of article.

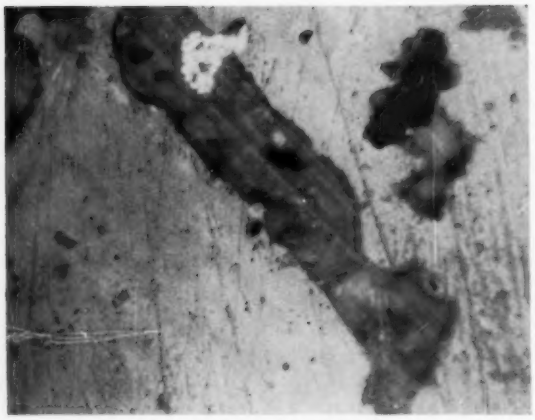

Fig. 1. Fibers incased in air pocket.

Fig. 2. String of air bubbles over fiber.

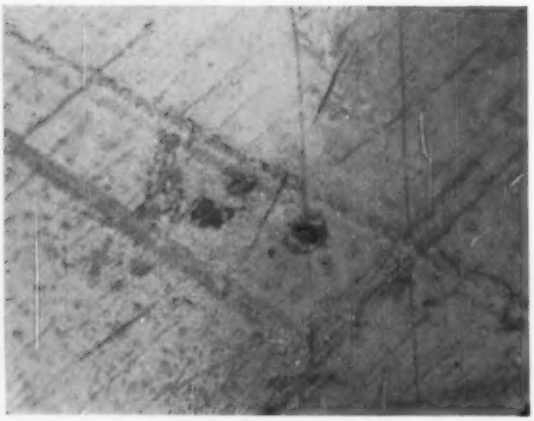

Fig. 3. String of air foam over fibers.

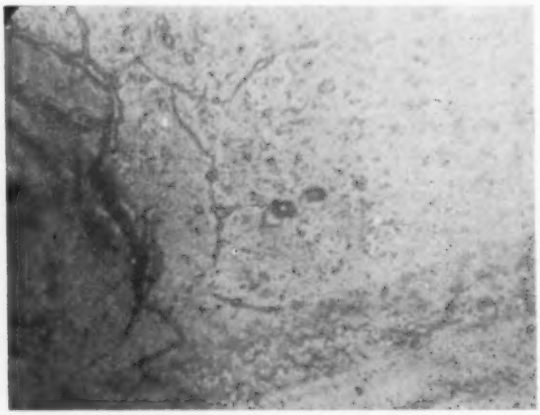

Fig. 4. Air worms.

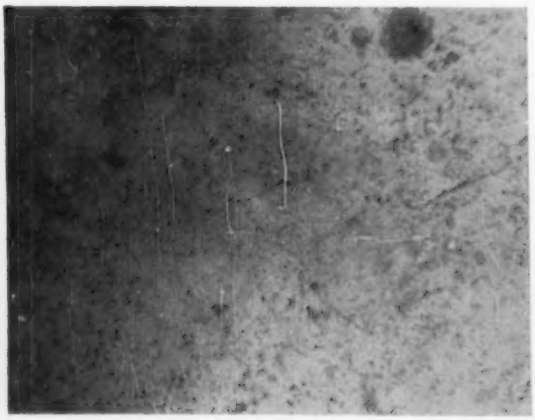

Fig. 5. Air worm network.

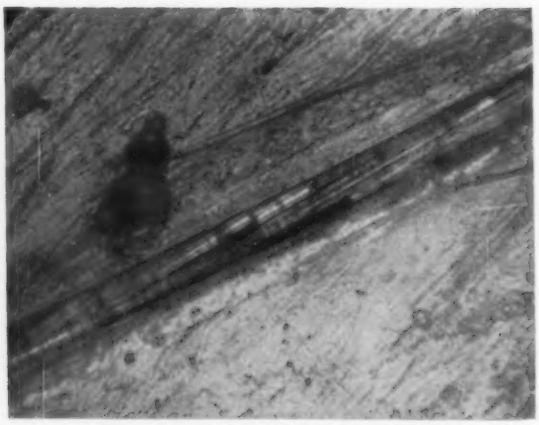

Fig. 6. Broken fibers exposed in longitudinal, wide crack.

longitudinal arrangement presumably through interactions with fibers close to the surface. In Figure 2, each bubble is a distinct separate entity, approximately spherical in shape. In Figure 3, the bubbles are more prevalent and appear as a foam-like mass above the fiber, which is well below the surface.

Figure 4 shows a number of elongated air bubbles sometimes found in localized areas of complex parts. In every case observed, these air worms have been slightly below the resin surface and are not associated with fibers. Two theories have been advanced for their origin:

1.—A large air bubble is present within the part and rises toward the mold surface. If the top layer of resin has gelled, this hot air bubble expands along the path of least resistance through the gelling resin thus forming the air worm.

2.—A number of small air bubbles, expanding as the temperature increases, join to become a larger which would be spherical except that sections of the resin gel resist expansion in certain directions.

Under certain circumstances, these air worms cover entire areas of the surface in a pattern which resembles the grain structure of metals (See Fig. 5.). All gradations between single air worms and the complete pattern have been observed. Other defects found in the "as-molded" surface of fiberglass-reinforced polyesters are associated with resin-glass bond failures as shown in Figures 6-11. McGarry and associates (3), (4), (5), (6), (7), (8), and (9) have associated resin-glass bond failures with structural strength and Newman et al (10) have reported some of the effects of bond failure on surface erosion. Our microscopic study showed that the bonds are either non-existent or very weak in the original molded parts and that service stresses, for the most part, propagate existing weaknesses.

The above-described characteristics affect service life of the fiberglass-reinforced polyester surface in an easily predictable fashion. To verify these predictions, separate samples were subjected to two radically different types of stress: a long-term stress-creep bending load according to the procedure of Gauza and Bartoe (11), and a single reverse impact blow with a modified Izod-type tester in which the sharp hammer is replaced with a rod.

After stressing, the samples were stained with ink to facilitate examination. In every case, surface failures originated at the site of previous surface imperfections or resulted from resin-glass bond failures. Some of the observed failures were: fracture of the thin resin coating over air pockets (See Fig. 11), cracks joining air bubbles over fiber, cracks over air worms, cracks extending longitudinally along fibers from exposed sections (See Fig. 10), enlargement of cracks along and over fibers (See Figs. 7, 8, and 9), spallation of resin over fibers near surface (See Fig. 7), and fiber popping (See Fig. 6).

It is obvious that all the defects previously enumerated are ideal lodgement areas for soil (See Fig. 11) when the part is subjected to service stresses. This surface deterioration will continue throughout the life of the part and soiling will continue on an expanding scale. Poor part design will accentuate deflection under load

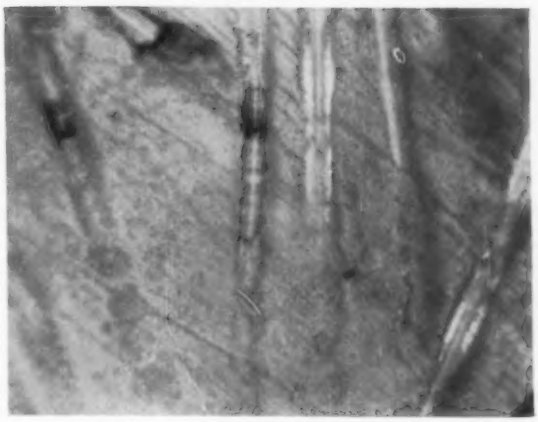

Fig. 7. Fibers close to surface partially exposed by spallation.

Fig. 8. Cracks beside resin covered fiber close to surface.

Fig. 9. Partially exposed fiber. Note crack in resin over fiber.

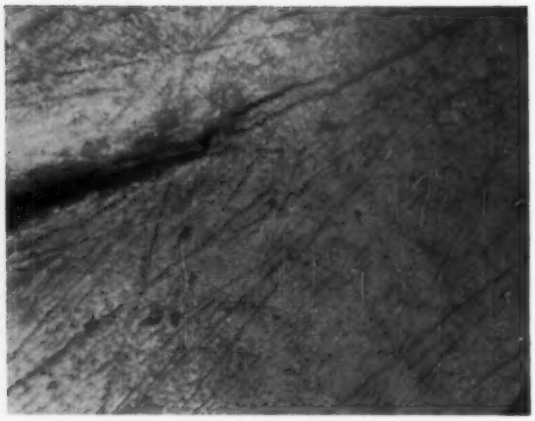

Fig. 10. Crack extending into resin at end of exposed fiber.

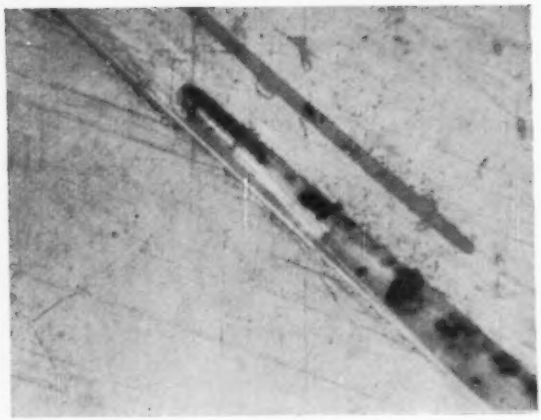

Fig. 11. Former air pocket which has cracked open, then entrapped soil.

and accelerate failures.

The molder can do much to prevent these surface defects. Mixing procedures must be improved so that air is eliminated from the mixture. It would seem advisable to add a deaeration step after mixing. Preform saturation and pouring pattern must be controlled to obtain optimum wetting. Cure temperatures and molding cycles should be established for minimum thermal contraction.

Final and complete solution of the problem, however, depends upon the resin and fiberglass suppliers The industry needs a very wettable glass fiber with a real chemical coupling agent as well as a tough reisn which will bond tenaciously to glass. With these two materials, we should be able to produce parts with superior surface characteristics. Furthermore, when we improve the surface, the internal structural strength will likewise be enhanced and thinner, less expensive products can be molded.

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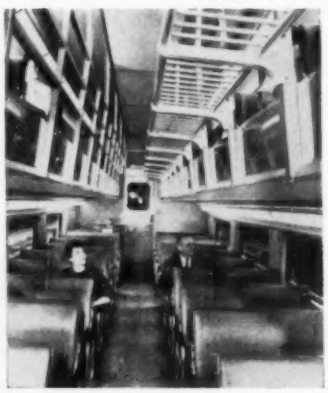
—THE END

Vinyl-coated steel for railroad cars

Sheets of steel coated with vinyl are being used to reduce maintenance costs and brighten the appearance of commuter cars on the Chicago and North Western Railway. Walls and ceilings of the double-deck cars are finished in shades of yellow, blue, gray, and green vinyl with stainless steel trim.

The material is supplied by United States Steel Corp. At its Irving, Pa., works, U.S. Steel cures and bonds liquids plastisols to the metal in a continuous mill coating process. The sheets are shipped to the S. Chicago plant of Pullman-Standard Division, Pullman Inc., where they are cut, formed, and fastened into place in the railroad car interiors.

The vinyl-coated steel sheets are reported to have great scuff and abrasion resistance, especially when compared with the painted metal interiors which they have replaced. Designed to compete with such materials as aluminum, reinforced plastics, pressure-processed wood products, and the older vinyl-laminated steels, the sheets may also be used in furniture, wall panels, picnic coolers, and television cabinets. It may be bought in any color the customer specifies and in any texture that can be engraved on a roll.



Interior of a Chicago two-deck and North Western commuter car.

—THE END

Economy through bulk shipment

Volume consumption plus competition make it vital that the processor look into bulk materials handling.

DON B. SEMEYN*

"Carload lot" today is more than a shipper's term—it describes the size of the package. In 1950, the Dow Chemical Company introduced the so-called "bulk package"—a 1,000 pound carton. Currently, 100,000 pounds is closer to the mark.

With the normal increase in volume and in competition that a healthy industry enjoys, it is natural for the fabricator to investigate efficiency and economy. One important area where savngs are possible is materials handling, especially bulk shipment of plastic molding materials. Bulk containers cut raw material cost, warehouse space, materials handling labor, spillage, and rejects due to contamination. Many raw materials producers now provide bulk shipments. A review of the major types should interest fabricators considering conversion to bulk receiving equipment.

Dry-Flo Car Shipment

We ship both polyethylene and Styron (Dow polystyrene) molding powders in a bulk hopper car. This has become one of the most widely used methods of bulk shipment because it offers the highest degree of efficiency and the most savings. The Dry-Flo car by General American Transportation Corporation is a 3,500-cubic foot rolling container lined with a durable coating to protect contents from contamination. The car is divided into three separate compartments, each with two hopper-shaped bottoms especially fitted for pneumatic unloading. Stainless steel is used here for cleanliness and durability.

Loading is from silo storage, either by gravity or by pneumatic conveying. Use of Dry-Flo car or any returnable bulk container eliminates the expense of bags or other customary containers. Silo storage makes a large warehouse area unnecessary. These factors allow a bulk price discount.

After the car is weighed, filled, and all openings are sealed, the amount of material is determined by subtracting the car weight before from its weight after filling. The 3,500 cubic foot cars will hold up to 115,000 pounds of polyethylene or 130,000 pounds of polystyrene pellets or granules.

Hopper Car to Silo

The fabricator's unloading site should be paved to reduce dust and should be as close as possible to his storage silos. Unloading is accomplished with a vacuum system using a flexible, stainless-steel hose secured to a bottom connection of the car. A filter is installed at the identical connection on the opposite side for conveying —air entry and another filter in one of the top openings in each compartment for replacement air as the material flows out. A valve is cracked to allow material to flow from the hopper down into the pneumatic section of the car, through the pneumatic system, and into the storage silo. The flow rate should be approximately 8-10 tons per hour so that the car can be unloaded within a single work shift.

A 30-40 hp. blower and 4-inch diameter tube is used to convey the material. For polyethylene, this tubing can be all aluminum. For polystyrene, aluminum straight sections are satisfactory, but the bends should be of stainless steel since the granules are sharp and abrasive. To eliminate unnecessary resistance in pneumatic systems, bends should be generous—one foot radius for each inch of diameter. Actually, a combination negative/positive pressure pneumatic power unit is used to unload Dry-Flo cars (see Fig. 1).

* Customer Service Engineer, Plastics Technical Service, The Dow Chemical Co., Midland, Mich.

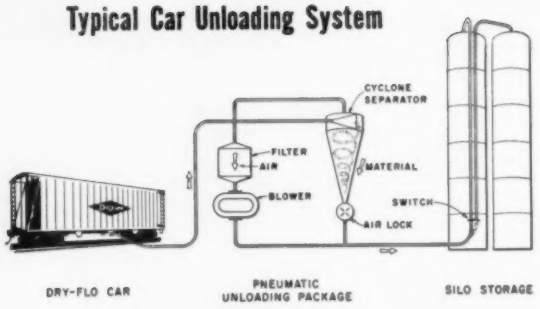
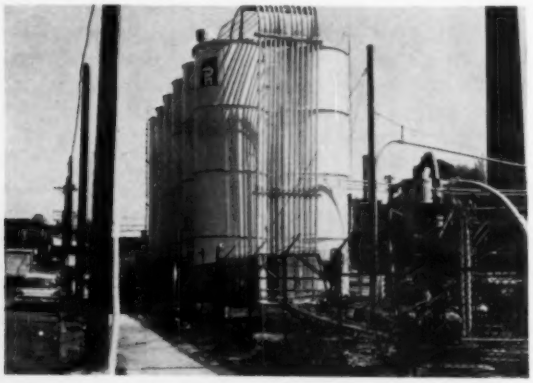


Fig. 1. Schematic diagram of a combination suction-pressure pneumatic conveying system for unloading a bulk rail car.

Material is sucked from the car and blown into the silo which serves as a separator for the conveying air and the plastic granules. Material does not pass through the fan to effect this change from negative to positive pressure. It is deposited by suction in a cyclone separator from which the air is pulled by the blower. This same air, after being compressed, is fed underneath the cyclone where the material is dropped back into the air stream through an air lock. The air lock, usually a rotary vane-type valve, is powered by a small fractional horse motor. The pressure differential across the fan approximates 5-10 psi., which is completely satisfactory for granules ⅛-inch in diameter and ⅛-inch long.

Aluminum silos are satisfactory from a contamination and durability standpoint, but epoxy-lined steel silos appear more economical. Several silos should be installed so that a void space is available to unload a car and still have inventory for current production. A suggested minimum is two silos of 3,500 cubic-foot volume, or a number of smaller silos if mixed shipments are contemplated.

Problems arising from outdoor storage are coldness of the material, condensation, and insects. The latter is the most serious, but can be easily controlled by placing an electrostatic screen at the silo vent of the silo or by leading the vent to a bag type dust collector. Because condensation could be a result of coldness, the two go hand in hand. Plastic materials in general, polystyrene and polyethylene in particular, are poor conductors and therefore do not lose their heat rapidly. In addition, they are not hygroscopic and any condensation will be only on the surface. This can be removed quite easily by the conveying air that takes the granules to the machine hoppers (since it is heated when compressed). For special applications, hopper dryers are used.



Butler epoxy-lined steel storage silos at Plastic Horizons, Inc., hold 60,000 pounds.

Polyethylene and polystyrene granules are loaded at a minimum temperature of 65° F. The bulk of material in the hopper car will retain this temperature for a long period of time (longer than necessary for shipment to most points). Average temperature drop is not more than 10-15°. Material will probably be moved from the silo to the fabricating machine within a week, or within two weeks of the time the hopper car was loaded. Temperature drop over this period has been determined by experimentation to be very slight at the center of the large container. Molding and extrusion tests run on cold material taken from a test storage silo in Midland, Michigan, during the winter and also during early spring of 1959 showed no evidence of moisture increase as compared to material of the same lot kept inside.

Silo to Machine Hopper

Material handling from silo to machine hopper can be accomplished in a number of ways, based on the complexity of operation and layout of the fabricator's plant. If material is to be dry blended for color, the silo can be placed directly over a tumbler blender which can be placed on weigh cells. Dry blended materials do not handle well pneumatically, so the material must be transferred to relatively small containers and taken to the fabricating machine. Of course, silo material can drop by gravity directly into tote boxes or other containers.

A secondary pneumatic system can be utilized to maintain full hoppers at all times from the selected silo. The expense of this secondary system will be determined by the amount of automation desired. Flexible tubing can be used, or hand operated valves for the simplified systems. Remote control can be installed, with solenoid or pneumatic valves controlled from a panel board indicating flow of material, level of hoppers, etc. This secondary pneumatic system requires a capacity of but two to three times the actual use rate of the plant.

Silo storage releases warehouse area for other uses such as new production machines, assembly area, or storage of finished parts. This obviates the need for expanding the building when expanding fabricating operations. Pneumatic handling from the silos to the machine hoppers frees space next to the machines formerly used for materials supply, thus eliminating traffic in the aisles and saving material handling labor.

A complete pneumatic system from receiving container to the machine hopper will increase the quality of the material, since it is neither touched by human hands nor exposed to the atmosphere of the plant.

Sealdbin Containers

The U. S. Rubber Company's 300 cubic-foot Sealdbin has been well accepted as a shipping container for polyethylene and polyvinyl chloride. It has some attractive, unique characteristics. It is collapsible, so that re-

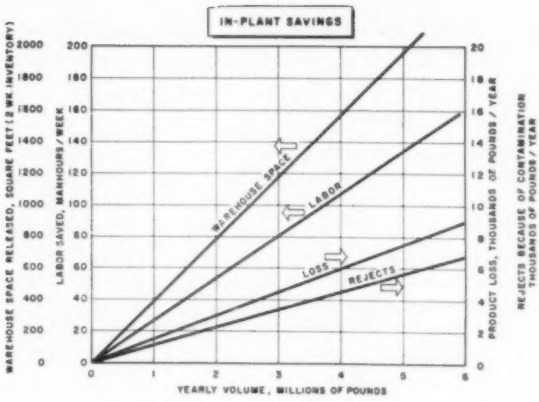


Fig. 2. Expected savings within the plant.

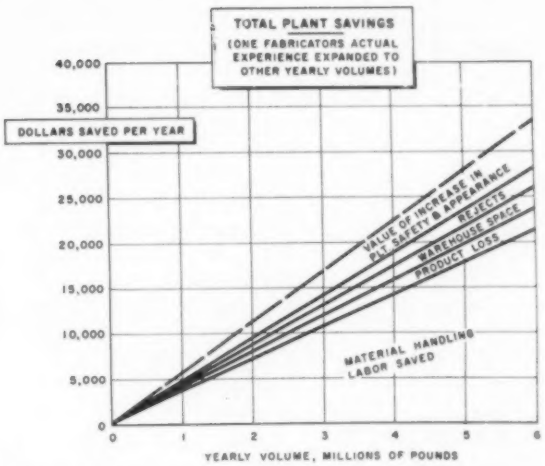

TOTAL PLANT SAVINGS
(ONE FABRICATORS ACTUAL EXPERIENCE EXPANDED TO OTHER YEARLY VOLUMES)
DOLLARS SAVED PER YEAR
VALUE OF INCREASE IN PLT. SAFETY & APPEARANCE
REJECTS
WAREHOUSE SPACE
PRODUCT LOSS
MATERIAL HANDLING LABOR SAVED
YEARLY VOLUME, MILLIONS OF POUNDS

Fig. 3. Savings shown in Fig. 2 converted into dollar values.

turn shipment of the empty container requires little space. It is a pneumatic container, and can be charged with an inert gas if air might be harmful to the product. Being flexible, it is relatively free from handling damage. The Sealdbin is made of reinforced Neoprene; the entire body being about the thickness and construction of an automobile tire sidewall.

Large quantities of material can be handled in an amazingly short period of time. A gondola car, containing seven 300 cubic-foot Sealdbins, can be unloaded and the material placed in storage within a half hour. Storage, of course, would be outdoors since the container is completely weatherproof. They can be shipped either by truck or rail. An open truck trailer can carry three of these containers.

Sealdbins can be handled by a large lift truck, an overhead monorail, or an overhead crane system. The most common method in use is the lift truck due to its maneuverability. A special unloading stand is required for emptying Sealdbins. It consists of a group of air-operated fingers which form a conical bottom in the container as it is emptied. A flanged opening at the bottom contains an integral sock which is pulled out and tied to a receiving tube. There is no spillage, since the sock itself is tied before the container is filled.

Material is transferred by gravity flow and a vibrating conveyor or pneumatic conveyor directly to the hopper. A restraining hook at the unloading stand keeps the Sealdbin from sagging, since the weight of the container alone is 500 pounds. The 300 cubic-foot Sealdbin will hold 7,000-10,000 pounds, depending on the bulk density of the material.

Air Slide Cars

During the summer of 1960, Dow began to ship PVC in Air Slide railroad cars as well as Sealdbins. The Air Slide car, a product of General American Transportation Corporation, is made especially for powdered materials. Like the Dry-Flo cars, it is of plain steel fabrication with stainless steel pneumatic fittings. Built into the shallow bottom slopes of the car is a porous medium through which air actually bubbles up into and through the material. The powder "floats" on these bubbles and will slide by gravity at a very slight angle to the center openings of the car.

Materials can be conveyed from car to silo with the conventional low pressure system described for the Dry-Flo car. In the pneumatic handling of powdery material it is vital that an efficient bag-type dust collector be utilized. This prevents damage to the suction blower and loss of valuable material. Where possible, it is desirable to use a medium, or high pressure pneumatic system for handling PVC or powders.

Tote Bins

Aluminum and magnesium Tote Bins manufactured by Tote Systems, Inc., are being used within the Styron warehouse in Midland for efficient handling and packaging. These rigid, dust-tight containers hold 74 cubic

Filling a 70 cubic-foot Sealdbin with Saran.

feet of material (approximately 2,700 pounds of polystyrene). This prevents their use as bulk shipping containers.

The Tote Bin can be unloaded from a truck or rail car with a conventional fork lift truck. Storage and handling within the plant should follow procedures used with 1,000 pound cartons. A special tilting mechanism is required to empty the Tote Bin, and it may be placed either above the machine hopper or dry blender, or at floor level with material being conveyed into the machine hopper with a conventional hopper loader. The principal advantage of the Tote Bin over other expendable containers is the movement of a larger volume of material at one time. Returning empty Tote Bins is expensive, and the greater distance these empties must travel, the less attractive they become as a bulk shipping container.

Trucks, Trailers & Inter-Plant Shipment

Equipment has been installed recently at the Allyn's Point, Connecticut, plant for loading and shipping bulk trailers. Because they must return empty, they are considerably more expensive than the bulk railroad car or the Sealdbin. It should also be noted that the weight of railroad cars is not chargeable in shipping a commodity; only the material itself is charged, and the car is returned free.

The bulk trailer is of aluminum construction. An integral part is the pneumatic package which will unload the trailer into a customer's silo within a very short time, and which is handled by the truck driver. The bulk truck can, of course, drive into plants that are not served by railroads and can maneuver next to a silo eliminating long tubing runs. When there is a return shipment, real economies are obtained.

The movement of polymer from the Saran Polymer Plant to the Warp Film Plant in Midland is being done satisfactorily in 70 cubic-foot Sealdbins. They are loaded on a powered monorail, which runs in a closed loop with empty containers being directed to the filling station. They continue through a storage portion of the monorail and eventually arrive at a doorway for pickup by a small lift truck and conveyance to an outdoor storage area. This same lift truck pulls transfer wagons to the Saran Wrap Plant which is about a half mile away.

Later, the containers are taken into the building where they are lifted to the second floor and carried to the unloading spot with a crane. A small tube from each extruder hopper extends up through the second floor of the building and connects to the bottom opening of the Sealdbin. One man transfers all material from the Polymer Plant to the Saran Wrap Plant and maintains full hoppers for a battery of extruders. The cleanliness of this bulk system has contributed to the efficiency of the manufacture of ½-mil Saran Wrap.

Pelaspan, Dow's expandable polystyrene beads, will soon be shipped in the 70 cubic-foot Sealdbin at a considerable saving over the currently used aluminum barrier drum.

Cost and Savings

Both costs and savings will vary for each application of bulk handling because of differences in plant layout, methods, and volume of material used. Dow's engineers estimate 150,000 pounds per month consumption of a single material as an approximate break-even quantity for bulk handling. At this volume, the savings would pay for the capital investment in handling and storage equipment within approximately 18 months. Broadly speaking, the larger the container used, the higher the investment and the savings.

The cost of converting to receive and handle bulk shipments will approximate $15,000.00 for a simple, short unloading system using bulk railroad cars. Another $5,000 should be allowed for storage equipment, and an additional $5,000-40,000 for moving material from the silos to the machine hoppers (depending upon the degree of automation desired). A large lift truck for handling 300 cubic-foot Sealdbins will cost $15,000, although this item can be leased. The unloading stand for the Sealdbin runs about $1,500.

Conveyance from Sealdbin to machine hopper can be quite simple or complex. Since the Sealdbins are adaptable for a customer using several formulations of the same material, perhaps two or more unloading stations would be desired. A fabricator receiving material by bulk truck merely installs storage silos and the secondary handling system. Storage silos would, of course, be much smaller than those needed for rail car shipments. A tilting mechanism for a Tote Bin will cost $1,200. The customer receiving the Tote Bin will probably already have a conventional, fork-type lift truck.

Conclusion

In computing labor costs in materials handling of present methods, it should be remembered that expendable containers have to be moved at least three times: from the truck or car to storage, from storage to the machine, and from the machine to a disposal area. These costs must be balanced against the anticipated labor costs of pneumatic hook-up to a car and maintenance of hopper levels. One quarter of 1% would be a good figure to use in calculating product loss through breakage of disposable containers, spillage, and material left in the containers.

If the cost of rejects because of contaminated material is known, it can be added to the savings. Although they cannot be assigned a dollar value, the improvement in plant appearance, efficiency, and safety should be taken into account. Of course, there is the primary reduction in raw material cost—a reflection of the material supplier's savings through the use of bulk containers. —THE END

Thermoforming—An old process, but a new industry.

L. J. ZUKOR*

Thermoforming predates modern man. However, it is only within the last 10 years that machines have been available for automating the process. Any thermoplastic material can be shaped by thermoforming; cellulosics, styrenes, polyolefins, vinyls, and acrylics being the materials most commonly used.

Commercially available thermoforming equipment includes both general-purpose machines and special units developed for packaging. The latter can be described as blister or skin-pack units which can be further modified to become integrated packaging machines. These automatic units form the sheet, insert the product, seal the sheet to plastic or board substrate, die-cut the individual package, and eject a final product. They may even include printing attachments.

Factors determining machine selection are end product configuration, rate of production, type of plastic used, size of forming area, and maximum depth of part. Many machines accommodate both roll or sheet stock. Automated roll feed devices are usually available at extra cost. Stock size standards have been established through the close cooperation of material suppliers and machine manufacturers. Film thicknesses run to 30 mils, sheet stock in thicknesses of 15-300 mils.

Thermoforming is the general term applied to all types of post forming operations. The four general methods are vacuum, pressure, matched mold, and free blow; however, we shall concern ourselves with the first two methods which are the mainstays of thermoforming shops. In brief, an automated machine could comprise a clamping device to hold the sheet firmly about its periphery while it is heated and drawn; a heating device which can heat one or both sides of the sheet and which can spread heat evenly over the area or adjust it according to a predetermined pattern (zone heating); assistance, usually in the form of a plunger, which can freeze and preset the thickness of a desired area or introduce stretch in the sheet to facilitate a deep draw; and a form-fitting or incomplete mold, either male or female. An incomplete mold will allow the sheet to form its own radii in the corners.

Machines used for pressure forming resemble those used in compression molding and metal stamping and are operated pneumatically, hydraulically, or by means of mechanical toggle-type mechanisms. Although vacuum often assists in pressure forming, the machines are too highly specialized to do straight vacuum forming. They are characterized by a shallow draw and are high speed units. Pressure forming, unlike vacuum forming, uses conduction heating—the sheet coming into direct contact with a heated platen.

In vacuum forming, atmospheric pressure acts on one side of the sheet against vacuum on the other. This causes the heated plastic to conform to the shape of the mold. Radiant heating elements, mounted in reflectors, move in and out of position as determined by a cycle timer. Proper heating prevents sagging before the gel point is reached. Extra heavy gage materials are preheated in auxiliary ovens or in a fluid medium, i.e.—a ½ inch thick acrylic sheet is heated for 24 hours at 180-200° F. to assure complete heat penetration.

Heating elements should be selected for the highest capacity operable with existing circuits. It is better to cut the heat for the more readily softened materials than to run a heater at full capacity or overload it, thus shortening its service life. Unless product dimensions are determined beforehand, it is also preferable to select a deep-draw unit.

Since some materials are more sensitive to heat than others, a vacuum forming unit should have a means for adjusting the distance between sheet or film and the infrared elements. Two basic control units are the feed back temperature controller and the cycle timer which determines the vacuum and air pressure cycles and platen movement.

Proper clamping pressure is important, since some materials (especially oriented film and sheet) tend to shrink when heated. Clamps must be tight enough to resist a pull of 5-10 psi. for non-oriented stock, but 75-100 psi. for oriented material. Adjustable clamps also reduce the amount of scrap which would otherwise accumulate if small parts are run on a large machine.

Some manufacturers offer forced-draft cooling fans, a cooling liquid manifold or cooled platens as standard equipment. Others supply coolers to specifications or as optional equipment. Such auxiliary equipment as vacuum supply, trimming dies, perforators for coated card stock, plug assists, and roll-feed mechanisms are also available.

* Engineering Editor

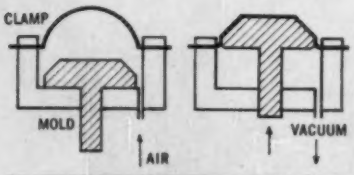
—THE END

PLASTIC SHEET CAN BE SHAPED BY MANY METHODS

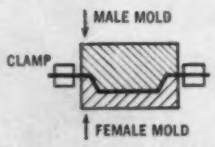
Vacuum, air pressure and mechanical pressure can be used to form sheet to desired contours. The diagrams below illustrate the various ways these three forces are used. Those marked with an asterisk are the most widely used in molding sign faces.

▬ = SHEET

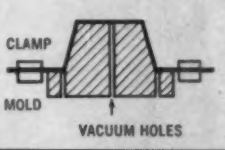
Pressure Snap-Back Forming



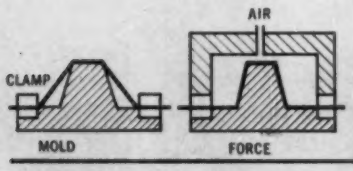
* Mold Forming—Male and Female Dies



* Drape Vacuum Forming —Male Mold

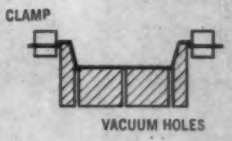


Blow Back Forming with Pressure

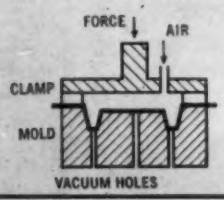


Grease Forming

* Drape Vacuum Forming—Female Mold

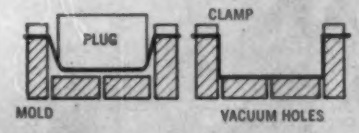


Pressure Forming —Female Mold

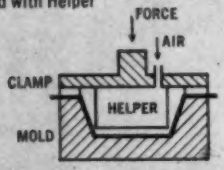


* Mechanical Forming

* Vacuum Forming with Plug Assist —Female Mold

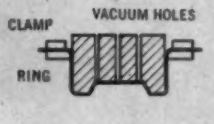


Pressure Forming—Female Mold with Helper



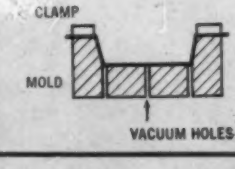
Free Blowing and Vacuum Free Forming

* Forming with Plug and Ring

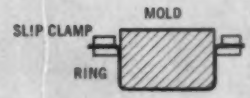


Ridge Forming

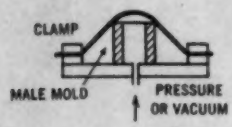
* Vacuum Forming —Female Mold



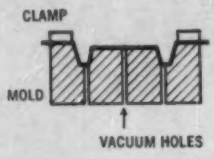
Mechanical Forming with Slip Ring



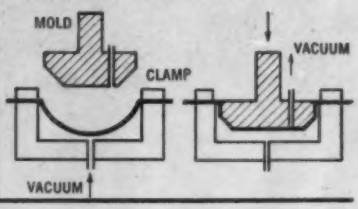
Ridge Forming with Vacuum or Air Pressure



* Vacuum Forming —Male Mold



Vacuum Snap-Back Forming



Sketches adapted with permission from Robert L. Butzko, "Plastic Sheet Forming," Reinhold Publishing Corp., 1958.

PT's Comparative data on 1961 Thermoforming Machines

Manufacturer*	Abbott			Air-O-Flow#					
Model number	A.P.M. 33	A.P.M. 503	A.P.M. 43	200-OH 3036	200-OH 3652	200-OH 3672	400-OH 4872	400 3036	400-OH 3652
Forming method##	C-P,S-P	C-P,S-P	C-P,S-P	C-P,PAF	C-P,PAF	C-P,PAF	C-P,PAF	C-P,PAF	C-P,PAF
Type of Controls	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Semi-auto.	Auto.
Type of feed	Roll feed			Cut sheets					
Forming area (LxW), min.-max., in.	30 x 30	20 x 26	40 x 40	30 x 36	36 x 52	36 x 72	48 x 72	30 x 36	36 x 52
Maximum depth of draw, inches	8	5	10	18	18	24	24	18	18
Rate of advance (min.-max.), in./sec.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Vacuum system: Pump motor hp.	1/2	1/4	1	- - -	- - -	- - -	- - -	- - -	- - -
working pressure (min.-max.) psia. inches	50 - 80	50 - 80	50 - 80	- - -	- - -	- - -	- - -	- - -	- - -
Time to pump down to 3 psia., seconds	30	20	20	- - -	- - -	- - -	- - -	- - -	- - -
Heating: Type	one	one	one	1	1	2	2	2	2
Number of independent zones	1	1	3	1	1	1	1	2	2
Heating area (LxW), in.	36 x 36	30 x 30	48 x 48	- - -	- - -	- - -	- - -	- - -	- - -
Space between sheet & heater, min.-max., inches	0 - 10	0 - 6	0 - 12	- - -	- - -	- - -	- - -	- - -	- - -
Cooling, Type of	Extra	Extra	Extra	Air type					
Ejection, Type of	Extra	Extra	Extra	Air and mechanical					
Special features	Furnished in 1- or 2-stations.	Loading table & cutter table included.	Furnished in 1- or 2-stations.	- - -	- - -	- - -	- - -	- - -	- - -
Optional features	Ram assist, 2-side heating, cooling & ejection.	- - -	Ram assist.	Vapor spray cooling.		Rapid-rate recovery vacuum pump.		High-speed compressor	
Approx. floor space (LxW), feet	3 x 10	5 x 8	4 x 12	6 x 8	7 x 9	9 x 9	9 x 11	6 x 12	7 x 14
Approx. delivery time, weeks	3	2	3	6 - 8	6 - 8	6 - 8	6 - 8	6 - 8	6 - 8

* Complete company names and addresses are as follows:

Abbott Plastic Machine Corp., 7124 N. Clark St., Chicago 26, Ill.
Air-O-Flow Industries, Inc., 74 Varick St., New York 13, N. Y.
Atlas Vac-Machine Corp., 1732 Hudson Avenue, Rochester 17, N. Y.
Auto-Vac Co., Div. of National Cleveland Corp., 1984 State St. Extension, Bridgeport 6, Conn.
Brown Machine Co., 110 Pierson Street, Beaverton, Michigan
Comet Industries, Inc., 9865 Franklin Ave., Franklin Park, Ill.
Hydro-Chemie, Ltd., Switzerland, (Sold by Conapac Corp., 120 East 13th St., New York 3, N. Y.)
Pacific Plastic Machinery, Inc., 3443 S. Lawndale St., Chicago 23, Ill.
Packaging Industries Ltd., Inc., 151 Pine Street, Montclair, N. J.
Precision Products Co., Inc., 252 East 16 Street, Paterson, N. J. ###
Product Packaging Engineering, 5713 Joanne Place, Culver City, Calif.
Producto Machine Co., Bridgeport 1, Connecticut ###
Sawaya Mfg. Co., Inc., 305 State Street, Tinidad, Colorado
Skin-Pak Machinery Co., Inc., 143 E. Railway Ave., Paterson 3, N. J.
Thermomat Co., Inc., 623 Prospect Avenue, Trenton 8, N. J.
Tronomatic Mfg. Corp., 25 Bruckner Boulevard, Bronx 54, New York
Zack Radiant Heat Co., 38-40 Ann Street, Passaic, New Jersey ###

\# Has more machines in addition to tabulated models

C-P: General-purpose vacuum-forming
S-P: Skin-packaging
P-F: Pressure-forming
D-F: Drape-forming
PAF: Plug-assist forming

In Custom-Made to Order listing.

Manufacturer*	Atlas Vac						Auto-Vac		
Model number	R-12 Portable Sampler	Form-N-Seal	Pressure Form-Er	PAC 20	H-18	A-14, 2-21, J-36	Pro Vac	Pak Master	MF 30 x 50
Forming method ##	G-P, S-P	G-P, P-F	P-F	G-P, S-P	G-P, S-P	G-P, S-P	G-P	Blister only	G-P
Type of controls	Manual	Auto.	Auto.	Auto.	Manual, Auto.	Manual, Auto.	Manual, semi-auto., or auto.	Auto.	Manual, semi-auto.
Type of feed	Cut sheets or roll feed.	Roll feed	Roll feed	Roll feed	Cut sheets or roll feed.	Cut sheets or roll feed.	Cut sheets or roll feed.	Roll feed	Cut sheets or roll feed.
Forming area (Lxw), min.-max., inches	12 x 12	To customers' specifications	10x10, 20x20, 24x30	20x20, 30x30	15x18	14x14 to 36x42	24x30	20x25	30x50
Maximum depth of draw, inches	4½	3	- - -	5	6	6 - 12	8	5	8
Rate of advance, etc.	- - -	1/6 cycle (min.)	20 in./6 secs.(min.)	20 or 30 in./ 10 secs.	- - -	14-36 in./ 20 secs.	- - -	- - -	- - -
Vacuum system: Pump motor hp.	- - -	- - -	- - -	1/2	1/3	1/3-1	3/4	3/4	5
Working pressure, etc.	- - -	- - -	- - -	26 hg.	26 hg.	26 hg.	0 - 29	0 - 29	0 - 30
Time to pump down etc.	- - -	- - -	- - -	1/4	1/4	1/4	60	60	60
Heating: Type	One side	Contact or 1-side radiant	Contact & radiant preheating	One side	One side	One side	1	1	1
No. of independent zones	Optional	- - -	- - -	Optional	Optional	Optional	1	1	1
Heating area (Lxw), in.	- - -	To customers' specifications.	To fit forming area	27 x 27	21 x 24	19x19 to 42x42	28 x 34	24 x 30	34 x 54
Space between sheet & heater, etc.	- - -	- - -	- - -	3 - 12	3 - 12	3 - 12	6	3 - 9	4 - 10
Cooling, Type of	Fans	- - -	- - -	Fans	- - -	Fans	Fans	Fans	Fans
Ejection, Type of	- - -	- - -	Auto.	Automatic air blow-off			Air blow-off		
Special features	Rugged construction. Portable.	Low-cost tooling. No limitations on blisters. Hydr. trimming	1 unit to auto. form & trim. Quick change-over. Form & trim press. adjustable.	Fully automated form & trim units 25-ton hydr. press cutting mech.	Lab. unit. Made in 2 styles, for manual or automatic operation.	Continuous auto. production. 4 styles of automation.	Automatic indexing with shear knife.		
Optional features	Timer control. Sandwich heater.	Auto. loaders to fill blisters.	- - -	Can be loaded from both sides.	Air supply included.	Skin-pkg. arrangements.	Plug assist.		
							Roll feed. Water-channeled clamp frame.		Water-channeled clamp frame.
Approx. floor space (Lxw), feet	- - -	- - -	9 x 3½	4 x 12	2-1/3 x 4-1/3	2x4-1/3 to 5x10	4 x 6	3 x 10	10½ x 9
Approx. delivery time, weeks	- - -	12 - 16	8 - 10	12 max.	4	6	4	4	6 - 8

Manufacturer*	Brown				Comet					
Model number	222	223 Rotary	22C Continuous	621	Meteor 3036	Lab-Master 1420	Star	Rotary-Vac	Blist-O-Matic	Quick-Pak 22
Forming method ##	By all known techniques.		G-P, D-F, PAP	All techniques.	D-F, S-P	Forms by all known techniques.				SP-DF-VP
Type of controls	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.
Type of feed	Cut sheets.				Film or sheet	- - -	- - -	- - -	- - -	- - -
Forming area (Lxw), min.-max., in.	30 x 36	12x12-42x72	10x10-36x30	12 x 18	1x1-30x36	1x1-14x20	30 x 36	12x12-42x84	4x4-24x30	6x6-22x30
Maximum depth of draw, inches	15	15	6	5½	15	10	30	25	6	6
Rate of advance, etc.	- - -	Station to station (4)	3.2-32 ft./min.	- - -	0-15 adj.	0-15 adj.	5-15 adj.	0-50	- - -	0-10
Vacuum system: Pump motor hp.	(Two) 1½	(Two) 1½	1½	- - -	1/2	1/2	3	5	2	2
Working pressure, etc.	- - -	25-28 Hg.	25-28 Hg.	- - -	3-28 Hg.	3-28 Hg.	3-28 Hg.	3-28 Hg.	3-28 Hg.	3-28 Hg.
Time to pump down, etc.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Heating: Type	2-sides	2-sides	2-sides	2-sides	1-side	2-side, enclosed		2 ovens	Contact	1-side
No. of independent zones	6 ea. bk.	12 ea.bk.	14 ea.bk.	10 ea.bk.	1	2	2	2	1	1
Heating area (Lxw), in.	32 x 38	42 x 72	35 x 40	12 x 18	40 x 35	16½x24½	65 x 41	48 x 54	28 x 34	28 x 36
Space between sheet & heater, etc.	- - -	8-12 ea.	- - -	- - -	2-22 adj.	2 - 8	10 & 24	14 - 24	2 - 8	2 - 10
Cooling, Type of	Fan	2 fans	- - -	fan	Fan	None	Fans	Fans	None	None
Ejection, Type of	Pneu.	Pneu. & mech.	Pneu.	Pneu.	Air & mech.	Air & mech.	Air & mech.	Air & mech.	Air & mech.	Air
Special features	Forms sheet up to 1½" thick.	Vacuum-bleed system for plug-assist work.		Has trim press. Forms as fast as 22C but indexes faster.	Bubble forming.	Double-platen units.	Adj.platen stroke.	Vac-forms 3x capacity of extruder.	Auto.load, slits, & unload from web stock.	Conveyor loading.
Optional features	Photo-electric circuit for bubble-height control in pre-blowing.		Sheet-support bands. Direct trim press.	- - -	Auto. feed & slitter, plug-assist attachmts. Also made in ..... 20- & 36x30, 36x60, & 48x84.	single-platen.	Also made in 36x60", 48x72", & 42x80"sizs.	Also made in 36x60", & 48x72" sizes.	Single platen	Automatic product loader.
Approx. floor space (Lxw), feet	- - -	14 x 16	7½ x 9	- - -	7½ x 4	3-3/4 x 2-2/3	9-1/6 x 7	16 diam.	3 x 10	7-1/6 x 11-1/6
Approx. delivery time, weeks	8 - 12	8 - 12	8 - 12	8 - 12	3 - 4	4 - 6	10 - 12	12	12 - 14	12 - 14

Manufacturer*	Hydro-Chemie				Pacific#					
Model Number	Formvac U-5	Formvac U-7	Formvac R-4	Formvac Junior	V3	V2	V1	Lab. Model	DP3	R6
Forming method##	G-P, All	G-P, All	G-P, All	G-P, All	G-P, S-P	G-P, S-P	G-P, S-P	G-P, S-P	G-P	G-P
Type of controls	Auto.	Auto.	Auto.	Semi-auto.	Manual, semi-auto., automatic →			Manual or semi-auto.	Semi-auto. & automatic →	
Type of feed	Cut sheets. →		Roll or cut sheets	Cut sheets.	Cut sheets or roll feed. →			Cut sheets. →		
Forming area	40x60 max.	60x88 max.	10x12 max.	10x12 max.	34 x 42	24 x 34	20 x 25	14 x 20	34 x 42	42 x 72
Maximum depth of draw, inches	24	32	7	7	16	16	16	5	30	20
Rate of advance, etc.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Vacuum system: Pump motor hp.	132 cu.ft. max.	132 cu.ft. min.	30 cu.ft. min.	4½ cu.ft. min.	1	1/2	1/2	1/3	1½	Not included
Working pressure (min.-max.), psia. in.	- - -	- - -	- - -	- - -	3 - 13	3 - 13	3 - 13	3 - 13	3 - 13	- - -
Time to pump down to 3 psia., seconds	- - -	- - -	- - -	- - -	100	100	100	100	100	- - -
Heating: Type	2-sides	2-sides	2-stations	1-side	Top heating →				2-sides	2-sides
No. of independent zones	4	6	2	1	3	1	1	1	2	2
Heating area (LxW), in.	45 x 65	65 x 95	11 x 13	11 x 13	40 x 48	30 x 40	26 x 31	16 x 24	40 x 48	48 x 78
Space between sheet and heater, etc.	- - -	- - -	- - -	- - -	3 - 25	3 - 25	3 - 25	4	6 - 20	2 - 20
Cooling, Type of	Provision for water cooling & heating of molds →				Adjustable fan. →			Optional	Adjustable fan. →	
Ejection, Type of	Air blast	Air blast	Air blast	Air blast	Compressed air. →					
Special features	Steplessly-adjustable clamp frames.			Hi-speed. Extreme depth: diam.ratio. Auto.feed & trim removal.	Single selector switch for all operations. →			Completely timed operation. Auto. draping & forming.	Completely versatile unit.	3-station rotary unit.
Optional features	Formvac Mould Temp. Regulator.	Air support. Auto.cycle delay.	- - -	- - -	Auto. sheet loaders. slitting & indexing. Roll feed Spray cooling. →			Fan cooling. Moving platen. Roll feed.	Auto. sheet loader or special auto. roll feed.	Auto. sheet loader.
Approx. floor space (LxW), feet	12 x 7	- - -	14 x 8	3½ x 4	9-1/3 x 5	7-2/3 x 4-1/4	7 x 3½	5 x 2½	10 x 5	18 dia.
Approx. delivery time, weeks	12	24	32	12	3 - 4	3 - 4	3 - 4	3	4	4 - 6

Manufacturer*	Packaging	Precision	Product Packaging#					
Model number	Sentinel RF-24-K	2, 2A, 3, 3A, 4, 4A, 4B	20, 28	2028, 2040	401, 401A	7A, 8A	2400, 6600	24 "DUO"
Forming method##	G-P	G-P, S-P	S-P, G-P	G-P, S-P	G-P, S-P	G-P, S-P	G-P, S-P	G-P, S-P
Type of controls	Automatic	Manual	Semi-auto.	Auto.	Auto.	Auto.	Auto.	Semi-auto.
Type of feed	Roll feed	Cut sheets	Roll feed	Roll feed	Roll feed	Auto.feed	Auto.feed	Roll feed
Forming area (LxW), min.-max., in.	6 x 20	8½ x 8½ to 10 x 20	14 x 18, 28 x 28	28 x 28, 20 x 40	36 x 36	20 x 28, 30 x 36	- - -	20 x 20
Maximum depth of draw, inches	1-3/4	3	8, 10	10	14	3	1, 1½	8
Rate of advance (min.-max.), in./secs.	2	- - -	- - -	- - -	- - -	4	8	- - -
Vacuum system: Pump motor hp.	3/4	Manual	--, 1/2	1/2	1	1/2	1	1/2
Working pressure (min.-max.), psia. in.	2 max.	- - -	0-65 in. water, 0-28	0 - 28	0 - 28	0 - 28	0 - 28	0 - 28
Time to pump down to 3 psia., secs.	- - -	- - -	--, 1½	1½	1½	1½	1½	1½
Heating: Type	1-side	1-side	1	1	1	1	2	2
No. of independent zones	3	1	1	1	1	1	2	2
Heater area (LxW), in.	25 x 25	11 x 11	24 x 24, 32 x 32	34 x 27, 27 x 47	31 x 46	34 x 27, 27 x 47	12 x 18, 18 x 18	27 x 27
Space between sheet & heater, etc.	8 max.	3/8 - 1	3-8, 3-11	3 - 11	3 - 15	1 - 4	0 - 3	3 - 8
Cooling, Type of	Water	None	Air	Air	Air	Air	Air	Air
Ejection, Type of	Automatic	None	None	None	None	Air	Air	None
Special features	Can be completely automatic. Auto. web control.	Portable bench models. Ready for use.	Mobile (Model 20 only)	Automatic oven. →		Blow-off, trimming, adj. film frame, auto. clamping.	Form, fill, print, seal & eject finished package.	- - -
Optional features	Edge-trim scrap chopper. Coupl'd cut-off knife.	- - -	Model 28: Auto.oven.	Blow-off, adj. film frame, auto. clamping. →		- - -	- - -	Auto. oven, blow-off, adj. film frame, automatic clamping.
Approx. floor space (LxW), feet	10-1/3 x 4-2/3	16 x 16 - 16 x 28	2 x 2, 4 x 4	2-2/3x4½, 6-2/3x6	5x8-2/3, 5x14½	6-2/3x6½, 6-2/3x7½	36 x 72, 48 x 72	38 x 38
Approx. delivery time, weeks	8	2 - 3	Stock	3	6, 8	10	12, 16	Stock

Manufacturer*	Producto			Sawaya			Skin-Pak		
Model number	Versa Form	Versa Form P-88	Versa Form P-1222	VF-4896	VF-1214	VD-2430	F	FJA	ED
Forming method##	G-P, S-P	P-F	P-F	G-P, P-F	G-P, P-F	G-P, P-F	G-P, S-P	G-P, S-P	G-P, S-P
Type of controls	Manual, auto.	Auto.	Auto.	Manual or semi-automatic.			Auto.	Auto.	Semi-auto.
Type of feed	Cut sheets or roll feed	Cut sheets or roll feed	Roll feed	Cut sheets	Cut sheets	Cut sheets	Roll feed	Roll feed	Roll feed
Forming area (LxW), min.-max., in.	20 x 20, 36 x 36	8 x 8	12 x 22	48 x 96	12 x 14	24 x 30	17 x 22, 22 x 34		
Maximum depth of draw, in.	5, 12	4	5	20	10	12	4*	4*	4*
Rate of advance (min.-max.), in./sec.	20-36 in./10 secs.	- - -	4	- - -	Adjustable	- - -	**	**	**
Vacuum system: Pump motor hp.	1/2, 1	None	Optional	Opt. to 5	Opt. to 1½	Opt. to 3	Continuous oil-cool pump.		
Working pressure (min.-max.), psia. in.	26 Hg.	- - -	- - -	29 Hg.	29 Hg.	29 Hg.	28 Hg.	28 Hg.	28 Hg.
Time to pump down to 3 psia., secs.	1/4	- - -	- - -	- - -	- - -	- - -	2 - 3	2 - 3	2 - 3
Heating: Type	1-side	1-side	1-side	1-side	1-side	1-side	1-side	1-side	1-side
No. of independent zones	Variable	None	Variable	12	1 unit	6	2 independent zones with greater intensity on 4 outside edges.		
Heating area (LxW), inches	22 x 22, 38 x 38	10 x 10	Variable	48 x 96	12 x 12	24 x 30	27 x 39	21 x 26	20 x 25
Space between sheet & heater, etc.	1 - 6	Contact	Contact	Adjustable.			1 - 6	1 - 6	1 - 6
Cooling, Type of	Fan	None	None	Optional	Air	Optional	Fan	Fan	Fan
Ejection, Type of	Air	Mech.	Mech.	- - -	- - -	- - -	Air	Air	Air
Special features	Tilting heater. Bldg.block automation.	P-F sampler.	Die cut. Bldg.block automation.	Ei-Mar process assures 100% detail and draw. Twin or single units.			Variable vacuum control. Variable timers for all control circuits.		
Optional features	Indexing. Slitting.	Hydraulic, preheat, plug assist. Indexing. Grinder.		- - -	- - -	- - -	Right-hand delivery table. Delay timer on heater. In-feed conveyor mounting.		
Approx. floor space (LxW), feet	3-2/3 x 5-1/6	2 x 2	3 x 9-1/3	9 x 10	2 x 5	3 x 9	5 x 8	4 x 7	3 x 5
Approx. delivery time, weeks	6	3	6 - 10	4 - 6	4 - 6	4 - 6	4 - 6	4 - 6	4 - 6

* 8" draw available on request.
** Can produce 2 finished cycles per hour.

Manufacturer*	Thermomat	Tronomatic					Zack
Model number	H-1818	Jr. VF 2020	VF2436	VF4872	PF1222	PF2430	F
Forming method##	V-F, D-F	G-P	G-P, S-P	G-P	P-F	P-F	S-F
Type of controls	Manual	Manual	Manual, semi-auto.	Manual, semi-auto. auto.	Manual, automatic.		
Type of feed	Cut sheets	Cut sheets	Roll feed or cut sheets	Cut sheets	Roll feed or cut sheets.		Roll feed
Forming area (LxW), min.-max., in.	18 x 18	20 x 20	12 x 12	48 x 72-48 x 18	12 x 22	24 x 30 max.	22 x 34
Maximum depth of draw, inches	7	6	6	20	4	6	4
Rate of advance (min.-max.), in./sec.	- - -	- - -	12 - 30	- - -	12 - 30	12 - 30	- - -
Vacuum system: Pump motor hp.	1/3	1/3	3/4	3	- - -	3/4	3/4
Working pressure (min.-max.), psia. in.	- - -	20-24 Hg.	20-28 Hg.	20-28 Hg.	- - -	20-28 Hg.	- - -
Time to pump down to 3 psia., secs.	35	25	15	15	- - -	15	- - -
Heating: Type	1-side	1-side	1-side	2-sides	- - -	1-side	1-side
No. of independent zones	1	None	4	4	- - -	Contact	1
Heating area (LxW), inches	22 x 22	22 x 22	24 x 36	48 x 72	12 x 22	24 x 30	27 x 39
Space between sheet & heater, etc.	3 - 7	3	3 - 9	12 - 33	- - -	- - -	2 - 4
Cooling, Type of	Blower	Fans	Cooled spray or fans.		Water cooling of molds.		None
Ejection, Type of	Air	Air & mech.	Air	Air	Air & mechanical.		Air
Special features	Foot operated drape mechanism.	Timers. Adj.clamp frame.	Preheat & feed constantly follows sheet.	Rotary unit. Non-draft heaters. Constant speed plugging attachment.	Full area blow plate. Fast change-over. Manifolded valves.		- - -
Optional features	Roll feed. Heat cycle timer.	Heating timer. Auto. operation.	Auto. shear. 2-roll let-off stand.	- - -	Double-roll let-off stand. Automatic feed. Shears.		Auto. take-off.
Approx. floor space (LxW), feet	4½ x 2½	2 x 3-1/3	10½x3-2/3	20 x 20	6-2/3x3½	1 x 3½	4-2/3 x 6-2/3
Approx. delivery time, weeks	3	2 - 3	3 - 4	6 - 8	6 - 8	6 - 8	5 - 6

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An over-all look at compression and transfer molding

L. J. ZUKOR*

In previous years, the articles accompanying our data on American made or distributed plastics processing machinery covered points to be considered when buying these machines, or auxiliary equipment for them. This article will attempt to cover the compression and transfer molding processes, tying in certain features of the machines and the materials used. If it seems a little basic, please remember that many new men have entered the field and much of the basic material is given in books which are no longer in print. Subsequent articles on automating the process, etc. have appeared under various headings and cannot be found in a single source.

Compression molding consists basically of bringing together two halves of a mold, one containing a cavity and the other usually a projection, thereby confining a pre-determined amount of material. The finished part conforms to the configuration set by the two mold halves.

Both thermoplastic and thermosetting resins can be molded by the compression method; however, the development of such techniques as injection molding from the older transfer method has practically relegated compression and transfer to the thermosets. The mold, if steam heated, could be reversed to carry cold water and set thermoplastics, which soften and become liquid on heating. Thermoset materials are not fully polymerized as are the thermoplastics, and require heat to polymerize and conform to the mold shape.

Still other materials, or combinations of resins and non-resins can be compression molded such as expandable polystyrene beads and cold-molded resins. The latter consist of two types generally described as refractory (inorganic) and non-refractory (organic). As electrical appliance fixtures, they serve as both heat and electrical insulators. Cold molding is like sintering except that the material, instead of being bone dry, has a tar-like consistency. Measured amounts are compressed in the mold at pressures of 5,000-15,000 psi. Parts are removed from the mold in the "green" state, after which they are baked or fired in ovens to hard, infusible masses.

True refractory compounds are not resins at all, but consist of clays, silica, and magnesia combined with special glasses. One such material, Mycalex, is a mica-glass mixture which is fired in the mold at high pressure and temperatures in excess of 1,000° F. These materials have the highest electrical arc resistance of all moldable compounds.

Compression press mechanisms

The basic (stripped down) compression press, with proper attachments, is used not only for compression and transfer molding but for pressure forming, dinking, die cutting, and laminating of sheet material. Presses are designed and built with mechanical toggle-type mechanisms, hydraulic mechanisms, or pneumatic unit mechanisms—or as hydro-mechanical or hydro-pneumatic mechanisms.

A toggle-clamp mechanism is an elbow-like linkage capable of increasing pressures at the end of its stroke. Theoretically, it can increase this force to the ultimate compressive strength of a steel column but, in practice, increases the work force only about 800%. This is due to the fact that a toggle, allowed to go to center, would lock and jam the mold.

Hydraulic mechanisms consist of a ram and yoke assembly which deliver force to the platens and then to the mold by the fluid pressure acting on the ram. This force is equal to the area of the ram multiplied by the fluid (line) pressure. Pneumatic mechanisms are similar, except that the ram or cylinder operates by compressed air. The hydro-mechanical combination uses hydraulic cylinders or motors instead of electric motor-driven fly wheels.

The hydro-pneumatic unit is a pressure amplifier system (pressure booster) which uses low-pressure air to generate high fluid pressures. The force amplification is equal to the inverse proportion of the cylinder areas (both hydraulic and pneumatic). This force is arrived at by multiplying the air pressure by the air cylinder area. Subsequent division by the fluid cylinder area and multiplication by the area of the hydraulic cylinder or ram gives the total force in pounds.

A = air cylinder area = 20 sq. in.
B = air pressure = 100 psi.
C = fluid cylinder area = 0.5 sq. in.
D = hydraulic cylinder area = 10 sq. in.
F = force in lbs.

$$\frac{A \times B \times D}{C} = F \text{ or } \frac{20 \times 100 \times 10}{0.5} = 40{,}000 \text{ lbs.}$$

* Engineering Editor

Air pressure acting alone would supply only 2,000 lbs. of force.

Electro-mechanical presses use an electric motor as the power unit to operate the various lever and geared mechanisms in a synchronous fashion. Hydro-mechanical units substitute the linear motion of a ram or the rotary motion of a hydraulic motor for the electric motor. All other mechanisms are the same.

Process, material, and formulation determine the proper design of a compression or transfer press. Our comparative listings describe certain basic presses which the manufacturer modifies to your needs. This is particularly true for the transfer press, which is already a modification of the basic compression unit. In essence, it is a modification of the basic two-part mold through the addition of a transfer pot. Transfer molding allows the forming of thin-walled intricate shapes or parts containing fragile inserts. Uncured thermosets of putty-like consistency will not flow readily into narrow channels.

Compression molding pressures are determined by multiplying the ram area by the fluid pressure and dividing by the projected area of the mold. A ram area of 20 sq. in., fluid pressure of 1,000 psi., and a mold area of 10 sq. in. would give a molding pressure of 2,000 psi. In transfer molding, pressures usually run higher but the flow of heated resin is slower, controlled, and directed into the mold cavities through gates. In designing a transfer mold, care should be exercised to see that the pressure within the mold is always less than the molding force generated by the press. The following example bears this out:

A = projected area of mold & runners = 10 sq. in.
B = transfer ram area = 10 sq. in.
C = transfer pot area = 2 sq. in.
D = hydraulic line pressure = 1,000 psi.
E = main ram area = 10 sq. in.

$$\frac{A \times B \times D}{C} = \text{Mold opening force}$$

$$\frac{10 \times 10 \times 1{,}000}{2} = 50{,}000 \text{ lbs.}$$

D x E = Mold clamping force
1,000 x 10 = 10,000 lbs.
50,000 lbs. being greater than 10,000 lbs. will cause the mold to open.

Most hydraulic systems are operated on two pressure lines: 500 psi. at a relatively high velocity for press closing; and 2,500-3,000 psi. for molding. There is no standard operating pressure; the limiting factor being the maximum design pressure stipulated by the manufacturer.

Press capacity is obtained by multiplying the maximum working pressure by the main ram area. Dividing this product by 2,000 gives the capacity in tons of force. If we divide this capacity by the contact area between the stationary and movable platen, we arrive at the unit compressive stress expressed in pounds per square inch or foot. This figure is necessary for laminating operations.

Automation

The next consideration is automation, and the decision to automate or not depends upon the type of operation conducted by the shop. No single run, however long, warrants the purchase of an automatic machine unless this type of business is sought consistently. If multiple cavity molds are required, the molder has no alternative but to purchase automatics. Cold-molded operations, on the other hand, are not automatic since cure takes place outside the mold.

Semi-automatic operation

Manual presses become semi-automatic through the addition of a cycle timer, which takes over from the operator after loading and start up. Opening and unloading are also manual operations. Cycle timers can also include mold temperature controls, which are generally mounted adjacent to or on the press with the controls for the electrical heating elements. When steam, hot water, or heated oil are used, their controls are generally located in the boiler or pump room. This type of arrangement is usually referred to as a "centralized" system as opposed to a "self-contained" system. Self-contained presses can be located anywhere in the shop, demanding only air, water, drain lines, and electricity.

Cycle timers are integral parts of automatic presses, but are added to semi-automate a basic press. Many operators seem to prefer the motor-operated cam-shaft type rather than clock-operated timer units, feeling that adjustment is easier and there is less chance of failure than with an all electrical system. When the cycle timer takes over after manual start-up, it operates small pilot valves which amplify the signals and perform the heavier work of moving the large control valves.

Solenoid valves are shunted from one position to another by electrical impulses. They do not do the actual work, but operate small valves which, in turn, operate much larger valves. All components are housed integrally.

A pneumatic pilot-operated valve uses low pressure air operating on a large area diaphragm which, in turn, changes the position of a larger valve. The pneumatic portion of this valve can be operated by a manual air valve, a solenoid air valve, or a cam-operated air valve. Whatever type valving is used, all valves are easily replaceable and it is a good idea to keep spares. Leaky valves are dangerous!

—The End

PT's Comparative Data on 1961 Compression and/or Transfer Molding Machines

(Based on data submitted by the machine manufacturers)

Manufacturer*	Atlas #				Baker				Battenfeld #	
Model number	Series 100	Series 200	Series 250	Series 300	60 & 75 Ton	100, 150 & 175 Ton	200 & 300 Ton	450 Ton	G	GI
Machine action	Manual or semi-automatic.				Automatic.				Automatic.	
Machine design type	Slab-side.			4-column	Top ram, open strain, rod-type, fully self-contained.				4-column.	
Press capacity, tons: Compression	20,30, 50,75	50,75, 100	50-300	50-300	60,75	100,150, 175	200,300	450	20	50
Transfer	To specifications.				Automatic.				12	15
Molding or working area, ## sq. in.	64-304	144-325	144-576	144-576	- - -	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	8	6 - 12	12 - 24	12 - 24	13	15	18	24	6.69	8.66
Opening	8	6 - 12	12 - 24	12 - 24	- - -	- - -	- - -	- - -	18	20
Speeds, inches/minute: Closing	60	60	To specifications.		400	400	400	400	- - -	- - -
Opening	60	60	To specifications.		400	400	400	400	- - -	- - -
Clamping	60	60	To specifications.		- - -	- - -	- - -	- - -	- - -	- - -
Pressing##	5	5	To specifications.		- - -	- - -	- - -	- - -	- - -	- - -
Platens or molds: Max. size, inches	8x8 to 18x18	12x12 to 18x18	12x12 to 24x24.		16x20*	20x24*	28x34*	36x42*	11x11	16x14
Number of platens	2 or 3	2 or 3	2,3,4,5,or 6.		- - -	- - -	- - -	- - -	2	2
Max. daylight opening, in.	8	6 - 12	12 - 24	12 - 24	29	33	38	42	- - -	- - -
Clamping force, tons	20,30, 50,75	50,75, 100	50-300	50-300	- - -	- - -	- - -	- - -	- - -	- - -
### Thickness (min.-max.), in.	- - -	- - -	- - -	- - -	10	12	14	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter, in.	- - -	- - -	- - -	- - -	2½	4	5	6½	- - -	- - -
Space between, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Steam, electric, or oil.				Electric	Electric	Electric	Electric	To customers' specs.	
Motor hp.	Manual or pneumatic	pneumatic	Depends on closing speed required.		7½	10,10,15	15,20	30	0.81	1.3
Approx. floor space (LxW), feet	1x1½ to 1½x2	1½x1½ to 2x2	3x3 to 5x5	2x3 to 5x7	- - -	- - -	- - -	- - -	2½x4-1/6	2½x4-3/4
Special features	Bench model for lab. use	Precision press for accurate research & testing work. Adj. hydr.press.	H-d prec. press for accurate deflection -free molding & laminating. Completely self-contained.		Flexible feeding & measuring loaderboard for all mold combinations. Upper and lower independent hydr. ejection. Meets J.I.C. standards. Deceleration at any time in pressing stroke. Breathe for any length of time. Throw-away type relays. All platens T-slotted. All cycles instantly adjustable. Ejectors supplied front to back and two options right to left.				Auto. bumping, cycling, and ejection.	
Optional features	Can be built to customers' specifications and controls.				Hydraulic side cores. Preheaters.				Auto. loading & piece removal.	
Approx. delivery time, weeks	4 - 6	6 - 10	6 - 12	6 - 12	- - -	- - -	- - -	- - -	- - -	- - -

* Much larger molds can be used.

* Complete company names and addresses are as follows:

Adamson United Co., 730 Carroll St., Akron 4, Ohio ####
Atlas Hydraulics Div., Delaware Valley Mfg. Co., Inc., 3576 Ruth St., Philadelphia 34, Pa. ####
Baker Brothers, Inc., 1000 Post St., Toledo, Ohio
Baldwin-Lima-Hamilton Corp., Hamilton Div., Hamilton, Ohio **
Battenfeld Corp. of America, 959 Grace St., Chicago 13, Ill.
Becker & Van Hullen, West Germany (Sold by Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill.)
B.I.P. Engineering Ltd., England (Sold by Ralph B. Symons Assoc., Inc., 3571 Main Rd., Tiverton, R. I.
Stewart Bolling & Co., Inc., 3190 E. 65th St., Cleveland 27, Ohio ####
Fred S. Carver, Inc., 1 Chatham Rd., Summit, New Jersey
Dake Corporation, Grand Haven, Michigan ####
Davidson-Kennedy Co., 1090 Jefferson St. N.W., Atlanta 18, Ga.
Dunning & Boschert Press Co., Inc., 329 W. Water St., Syracuse 2, N. Y. ####
Elmes & King Div., American Steel Foundries, 1150 Tennessee Avenue, Cincinnati 29, Ohio
Erie Engine & Mfg. Co., 953 E. 12th Street, Erie, Pennsylvania ####
Erie Foundry Co., Erie 6, Pennsylvania ####
Farrel-Birmingham Co., Inc., Watson-Stillman Press Div., 565 Blossom Rd., Rochester 10, New York
French Oil Mill Machinery Co., Piqua, Ohio ####
Hull Corporation, Hatboro, Pennsylvania
Hydraulic Press Mfg. Co., Marion Rd., Mount Gilead, Ohio
Ketchpel Engineering Co., 1401 Palisade Ave., West Englewood, N. J. ####
Kingsbacher-Murphy Co., Hydraulic Div., 9830 Bellanca Avenue, Los Angeles 45, Calif.
Knuth Engineering Co., 1720 N. California Ave., Chicago 47, Ill.
Miller & Van Winkle Co., Polystyrene Machinery Div., Sherman & Crosby Avenues, Paterson 2, New Jersey ####
New England Butt Co., 304 Pearl Street, Providence 7, Rhode Island
Pasadena Hydraulics, Inc., 1433 Lidcombe, El Monte, California
Rodgers Hydraulics, Inc., 7401 Walker St., Minneapolis 26, Minn.
Springfield Cast Products, Inc., 124 Switzer Avenue, Springfield 9, Mass.
F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.
Taccone Corporation, P. O. Box E-512, North East, Pennsylvania ####
Tronomatic Mfg. Corp., 25 Bruckner Boulevard, Bronx 54, New York ####
Wabash Metal Products Co., 1569 Morris Street, Wabash, Indiana

** Data from this company was not received in time for inclusion in the tabulation.

Has more machines in addition to tabulated models.

Depends also on molds involved.

Depends on daylight openings.

In Custom-Made to Order listing.

Manufacturer*	Battenfeld # (Cont'd.)	Becker & Van Hullen #				BIP #			
Model number	M	P 25	P 63	P 160	P 315	60 LT	150	200	400
Machine action	Automatic	Auto., semi-auto. & manual →				Auto., semi-auto., & manual →			Semi-auto. & manual →
Machine design type	4-column	Column type →		Frame type →		Modified side frame construction. →			
Press capacity, tons: Compression	150	25	63	160	315	72	170	225	450
Transfer	60	5	10	31.5	63	14	30 or 45	30 or 45	60 or 90
Molding or working area, ## sq. in.	- - -	387.5	870.25	872	1,395	400	650	650	990
Ram or plunger: Stroke, in.	13.78	11.8	14	22.2	39.3	14	18	18	24
Opening	30	19.7	21.4	15.35	9.85	- - -	- - -	- - -	- - -
Speeds, inches/minute: Closing	- - -	0-153.54	0-153.54	0-354.33	0-354.33	420	700	650	350
Opening	- - -	0-153.54	0-153.54	0-354.33	0-354.33	420	700	650	350
Clamping	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressing##	- - -	0-11.8	0-11.8	7-11.8	7-11.8	- - -	- - -	- - -	- - -
Platens or molds: Max. size, in.	19 x 19	13-2/3 x 19.7	19.7 x 27½	29½x29½	35-1/3 x 39-1/3	20 x 20	24 x 27	24 x 27	30 x 33
Number of platens	2	2	2	2	2	2 or more →			
Max. daylight opening, inches	- - -	31.5	35.4	37.4	49.2	30	38	38	60
Clamping force, tons	- - -	25	63	160	315	72	170	225	450
### Thickness min.-max.), in.	- - -	- - -	- - -	- - -	- - -	8 - 25	6 - 33	6 - 33	23 - 55
Posts, tie bars, or rods: Diameter, in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Space between, inches	- - -	13.8*	19.7*	31.5**	39**	- - -	- - -	- - -	- - -
Type of heating	(See preceding pg.)	Electric	Steam and electric →			Induction (electric), steam optional. →			
Motor hp.	3.3	2	4.2	12.2	15	5	7½	7½	10 - 15
Approx. floor space (Lxw), feet	3½x6-1/3	3-5/6 x 3-5/6	5x5-1/3	4-1/6 x 6-1/4	5 x 6½	30*	40*	40*	55*
Special features	(See preceding pg.)	Up-stroking. Suitable for all thermoset plastics. →		Down-stroking. →		Insul. & water-cooling. Lighted mold area. Adjustable guides. Adjustable slow close & opening. Hanging bar ejection (top & bottom). All safety features. →			
Optional features	(" ")	- - -	- - -	- - -	- - -	Indep.-controlled hydr. ejectors-top & bottom. Side rams. " " " -operated intermediate deck. →			
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -

* Between columns
** Between frames

* Square feet (operational)

Manufacturer*	Bolling #			Carver		Dake #			
Model number	OA	No. 1	No. 3½	12-Ton Standard	20-Ton Standard	27-202 (S)	27-204 (S)	27-206 (S)	27-209 (S)
Machine action	Manual or semi-auto. →			Manual	Manual	Semi-automatic. →			
Machine design type	Tie rod	Tie rod	Tie rod	Rod-type	Rod-type	Rod-type	Rod-type	Rod-type	Rod-type
Press capacity, tons: Compression	75	78	250	12	20	75	150	300	600
Transfer	As required. →			- - -	- - -	- - -	- - -	- - -	- - -
Molding or working area, ## sq. in.	196	324	576	36	64	1,400	2,880	3,300	5,320
Ram or plunger: Stroke, inches	12	20	18	5	6½	14	20	24	30
Opening	As required. →			16	16	- - -	- - -	- - -	- - -
Speeds, inches/minute: Closing	As required. →			Variable	Variable	240	285	190	210
Opening	As required. →			Variable	Variable	360	330	265	295
Clamping	As required. →			- - -	- - -	- - -	- - -	- - -	- - -
Pressing##	As required. →			- - -	- - -	1 - 30	1 - 17	1 - 8	1 - 7
Platens or molds: Max. size, inches	14 x 14	18 x 18	24 x 24	6 x 6	8 x 8	37 x 40	48 x 60	55 x 60	76 x 70
Number of platens	As required. →			2	2	2	2	2	2
Max. daylight opening, inches	As required. →			16	16	22	32	40	50
Clamping force, tons	As required. →			12	20	75	150	300	600
### Thickness (min.-max)in.	- - -	- - -	- - -	1	1	8 min.	12 min.	16 min.	20 min.
Posts, tie bars, or rods: Diameter, in.	2¼	2¼	3-3/4	1-1/8	1-3/8	3½	4½	7½	10
Space between, inches	14½	18½	24½	7-3/8	9-1/2	25 x 40	35 x 60	35 x 60	50 x 70
Type of heating	As required. →			Elect., steam, or thermal fluid. →		Steam or electric. →			
Motor hp.	3	3	7½	- - -	- - -	10	15	25	75
Approx. floor space (Lxw), feet	17 x 22*	24 x 20*	32 x 28*	21 x 16 inches	23 x 20 inches	5½ x 5-2/3	7x7½	7-1/6 x 8-3/4	9-3/4 x 9-1/3
Special features	As required. →			Bench model. Self-contained. →		All adjustments can be made from floor level. →			
Optional features	As required. →			Adj. cap for rapid adjustment of opening. →		Speeds, platen sizes, strokes, & other specifications to meet requirements. →			
Approx. delivery time, weeks	10	10	10	Stock	Stock	8 - 10	8 - 10	10 - 12	14 - 16

* Plus pump.

Manufacturer*	Davidson-Kennedy				Elmes & King				Erie Engine	
Model number	101, 102	103, 104	105, 106	107,108	7100	7300	7500	7703	50	100
Machine action	Manual and automatic. →				Semi-automatic. →				Manual or semi-automatic.	
Machine design type	- - -	- - -	- - -	- - -	4-column	4-column	4-column	4-column	Rod-type	Rod-type
Press capacity, tons: Compression	50	100	100,200	200,400, 200	100	300	500	1,000	50	100
Transfer	- - -	- - -	- - -	- - -	25	75	125	250	15	20
Molding or working area, ## sq. in.	- - -	- - -	- - -	- - -	Depends on material being molded. →				- - -	- - -
Ram or plunger: Stroke, inches	36	50	50	58	12 (C) 12 (T)	18 (C) 14 (T)	24 (C) 16 (T)	36 (C) 20 (T)	Variable	Variable
Opening	- - -	- - -	- - -	- - -	30	42	52	68	- - -	- - -
Speeds, inches/minute: Closing	700	600	500	400,350	285	300	310	265	Variable	Variable
Opening	300	300	300	300	245	185	165	200	Variable	Variable
Clamping	- - -	- - -	- - -	- - -	13	14	14	7½	Variable	Variable
Pressing###	0 - 15	0 - 15	0 - 15	0 - 15	60	54	52	24	Variable	Variable
Platens or molds: Max. size, inches	19 x 26	28 x 36, 32 x 46	38 x 53	48 x 84, 50 x 100	24 x 20	36 x 30	42 x 36	72 x 50	18 x 16	24 x 18
Number of platens	2	2	2	2	2	2	2	2	Optional	Optional
Max. daylight opening, inches	36	50	50	58	30	42	52	68	Optional	Optional
Clamping force, tons	- - -	- - -	- - -	- - -	100	300	500	1,000	- - -	- - -
###Thickness (min.-max.), inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter, in.	- - -	- - -	- - -	- - -	3¢	5½	7	9	- - -	- - -
Space between, inches	- - -	- - -	- - -	- - -	29 x 10½	41 x 15½	48 x 24	80 x 30	- - -	- - -
Type of heating	Steam or electric. →				Steam or electric. →				Optional	Optional
Motor hp.	- - -	- - -	- - -	- - -	5 and 3	20 and 5	30 and 5	50 and 5	- - -	- - -
Approx. floor space (LxW), feet	2 x 3, 3 x 4	3 x 4, 3½ x 5	4-1/6 x 5-2/3	5 x 8-1/3	7 x 4½	10 x 6	12 x 6	15 x 9	4 x 2½	5½ x 3½
Special features	Automatic bumping & ejection. Pyrometer temp. control. Operates on 100 psi. air pressure. Max. hydraulic line pressure, 6,000 psi. →				Automatic hydraulic knock-out with manual reset. →				- - -	- - -
Optional features	To suit customers' requirements. →				Bolsters & die supports. Top & bottom knock-out timer for preheat units. →				Design styles can be modified to meet customers' requirements. Can be equipped with pull-back or push-back cylinders. →	
Approx. delivery time, weeks.	- - -	- - -	- - -	- - -	12	14	14	18	14 - 16	14 - 16

Manufacturer*	Erie Engine (Cont'd.)		Erie Foundry				Farrel-Birmingham #			
Model number	300	750	Series 1110	Series 1120	Series 1130	Series 1150	9382 9382T	9383 9383T	9322 9322T	9565 9565T
Machine action	Manual or semi-auto. →		Semi-automatic. →				Semi-automatic. →			
Machine design type	Rod-type	Rod-type	4-rod	4-rod	4-rod	4-rod	Four-column open type. →			
Press capacity, tons: Compression	300	750	100	200	300	500	50	200	500	1,200
Transfer	75	200	25	55	75	125	12½	50	125	200
Molding or working area,## sq. in.	- - -	- - -	420	720	918	1,280	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	Variable	Variable	12 (C) 15 (T)	15 (C) 15 (T)	18 (C) 18 (T)	36 (C) 18 (T)	12 (C) 9 (T)	15 (C) 12 (T)	24 (C) 18 (T)	24 (C) 22 (T)
Opening	- - -	- - -	- - -	- - -	- - -	- - -	33*	40*	62*	62*
Speeds, inches/minute: Closing	Variable	Variable	235	270	435	400	220	230	210	100
Opening	Variable	Variable	235	240	435	400	220	230	210	100
Clamping	Variable	Variable	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressing###	Variable	Variable	10	19	21	25	15.6	12.5	8.2**	5.7**
Platens or molds: Max. size, inches	36 x 30	66 x 42	20 x 21	30 x 24	36 x 27	40 x 32	16 x 16	30 x 24	40 x 32	54 x 44
Number of platens	Optional	Optional	2	2	2	2	2	2	2	2
Max. daylight opening, in.	Optional	Optional	42	50	62	84	33*	40*	62*	62*
Clamping force, tons	- - -	- - -	100	200	300	500	50	200	500	1,200
###Thickness (min.-max.), inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter in.	- - -	- - -	3½	4-3/4	5½	7	2½	4¢	- - -	- - -
Space between, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Optional	Optional	- - -	- - -	- - -	- - -	None	None	None	None
Motor hp.	- - -	- - -	10	15	20	30	3	10	15	25
Approx. floor space (LxW), feet	6½ x 5	13 x 6½	5 x 3½	6 x 5	7 x 6	9½ x 6½	4x4-1/3	5x5-1/3	7 x 6¢	9 x 8
Special features	- - -	- - -	All presses provided with hydr. mold stripping cyls., separate advance cyls., slow break away speed, high pull-back tonnages. →				(C) Top and bottom k-o; fast die closing and opening with auto. slow-down prior to contact; individ. timers; inching valve for die-setting. Presses 500-tons & larger have auxil. gear pump giving hi- & low pressure pressing speeds. (T) Double-acting ram; selective control for either compr. or transf. molding; high degree of cycle control; hydr. stripping cylinders. →			
Optional features	(See above) →		Addtional degassing, adj. opening, bolsters & parallels for compr. & transfer. Stroke & daylight opening to order. →				(C) Degassing feature; adj. opening spacers; bolsters and parallel plates; adj. opening in two 4-inch steps. (T) Top bolster for compression molding; degassing feature. →			
Approx. delivery time, weeks	14 - 16	14 - 16	16	20	20	20	- - -	- - -	- - -	- - -

* Opening between platens.
** With auxiliary gear pump.

Manufacturer*	Hull #				HPM #				Kingsbacher-Murphy	
Model number	99A	359D	250,259, 450	350,359, 550	100 Ton	200 Ton	300 Ton	500 Ton	KM2	KM3
Machine action	Auto.	Semi-auto. or manual →			Semi-automatic →				Manual, semi-auto., auto. →	
Machine design type	Horiz. 2-rod type	Console 4-rod type	Vert. 4-rod toggle type	Vert. 4-rod ram type	Rod	Rod	Rod	Rod	Slab side →	
Press capacity, tons: Compression	15	28	50-300	50-300	100	200	300	500	20	30
Transfer	2	7	19-43	12½-75	35	50	80	125	- - -	- - -
Molding or working area,## sq. in.	15	324	324-1,120	324-1,120	432	720	1,080	1,512	64 or 108	156 or 231
Ram or plunger: Stroke, inches	12	8½	9½-12½	10-14	15	15	18	26	4	5
Opening	9	6	28-40	24-44	11	16	19½	25	0-8	0-9
Speeds, inches/minute: Closing	60 adj.	190	156-162	282-364	90	80	204	315	Manual or 114	Manual or 72
Opening	60 adj.	192	183-82	262-298	90	80	100	104	Gravity return →	
Clamping	60 adj.	0-25 adj.	0-14 adj.	0-13 adj.	- - -	- - -	- - -	- - -	- - -	- - -
Pressing###	60 adj.	0-25 adj.	0-14 adj.	0-13 adj.	12	8.6	12.5	13.4	- - -	- - -
Platens or molds: Max. size, in.	4½ x 7½	18 x 18	18x18-3/4 - 36x31 →		24 x 18	30 x 24	36 x 30	42 x 36	8 x 8, 9 x 12	12½ x 12½, 12½ x 18½
Number of platens	2	2	2	2	2	2	2	2	2 or more	2 or more
Max. daylight opening, in.	4½	21	28 - 40	24 - 44	30	36	54	54	8	9
Clamping force, tons	15	28	50-300	50-300	100	200	300	500	- - -	- - -
###Thickness (min.-max.), in.	2 - 4½	0 - 15	0 - 30	0 - 26	3 min.	9 min.	12 min.	12 min.	1½	1½
Posts, tie bars, or rods: Diameter in.	2 - 3/4	2½	2-9/16-4	2-9/16-4½	3½	4½	5½	6½	- - -	- - -
Space between, inches	8	18½	20 - 40	20 - 40	32-3/4	39½	44-3/4	51	- - -	- - -
Type of heating	Electric	Electric	Electric, steam, oil →		Steam, or electric →				Electric, Calrod or steam*	
Motor hp.	Air at 80 psi.	5	3 - 10	3 - 20	7½	10	20	45	Manual pump or 1.5 →	
Approx. floor space (Lxh), feet	7 x 2	5 x 3	6x5-8x10	6x5-9x10	31 sq.ft.	36 sq.ft.	53 sq.ft.	58 sq.ft.	1 x 1½	1½ x 1-2/3
Special features	Standard mold blocks.	Quickset controls. →			Both compression and transfer models available. →				- - -	- - -
Optional features	Modification for epoxy molding.	- - -	Hydraulic side cores.		Hot plates. →				Special heat-control units & pressure gages. Modifications to suit requirements. →	
Approx. delivery time, weeks	3 - 6	6 - 10	6 - 14	8 - 20	- - -	- - -	- - -	- - -	- - -	- - -

Manufacturer*	K-M (Cont'd.)		Knuth		New England Butt	Pasadena #			
Model number	KM5	KM7	#130	#160	X42, X43, X44, X45.	Q 230 Type	B 230 Type	H8 Type	K-10-360
Machine action	Manual, semi-auto., auto. →		Manual	Manual	Auto.	Manual	Manual	Semi-automatic. →	
Machine design type	Slab side	Slab side	Side-plate. →		Rotary	Bench	Bench	Floor model. →	
Press capacity, tons: Compression	50	75	1½	3	2½-30/ station	30	50	70	125
Transfer	- - -	- - -	- - -	- - -	6	156	156	342	600
Molding or working area,## sq. in.	156 or 231	361	64	64	32	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	5	5	7	7	6	4	6	8	10
Opening	0 - 9	0 - 11	5 - 9	5 - 9	6	5	5-3/4	6-3/4	9
Speeds, inches/minute: Closing	Manual or 72	Manual or 138	- - -	- - -	1.5 variable	- - -	- - -	- - -	- - -
Opening	Gravity return. →		- - -	- - -	1.5 variable	- - -	- - -	- - -	- - -
Clamping	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressing###	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Platens or molds: Max. size, in.	12½x12½, 12½x18½	19 x 19	7½ x 7½	7½ x 7½	3-3/4 x 8-1/2	12½ x 12½	12½ x 18½	18½ x 18½	24½ x 24½
Number of platens	2 or more	2 or more	2 - 4	2 - 4	10, 30	2 - 3	2 - 6	2 - 4	2 - 4
Max. daylight opening, in.	9	11	9	9	6	4	6	12	15
Clamping force, tons	- - -	- - -	- - -	- - -	2½ - 30	30	50	70	125
###Thickness (min.-max.), in.	1½	1-5/8	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter, in.	- - -	- - -	- - -	- - -	- - -	13*	13*	19*	26*
Space between, inches	- - -	- - -	8	8	- - -	- - -	- - -	- - -	- - -
Type of heating	(See above) →		Steam or electric. →		Electric	Steam or electric.	Electric	Electric	Electric
Motor hp.	Manual pump or 1.5	Manual pump or 3	- - -	- - -	7½ - 25	- - -	- - -	1½	3
Approx. floor space (Lxh), feet	1½x1-2/3	3 x 3	1 x 1	1 x 1	5 - 8-1/3	1 x 1-7/12	1-1/6 x 1-7/12	2-1/6 x 2-1/6	- - -
Special features	- - -	- - -	Table-top laboratory units. Stainless steel filter equipment. →		- - -	2-stage pump convertible to semi-auto. operation. Can be adapted to another 4 inches in daylight. →			
Optional features	(Same as above) →		Hot & cold plates. →		Unthreading mechanism for threaded parts.	Modifications to suit customers' requirements. →			
Approx. delivery time, weeks	- - -	- - -	2	2	14	- - -	- - -	- - -	- - -

* Slab sides.

Manufacturer*	Rodgers #				Springfield Cast Prods.				Stokes #	
Model number	TCMA-100-2420-10	TCMA-150-2420-20	TCMA-200-3024-10	TCMA-300-3630-10	Cycle-Matic Mold Press				726-0/728-0	726-3/728-3
Machine action	Automatic, semi-automatic, manual.				Semi-automatic.			Auto.	Semi-automatic.	
Machine design type	Rod-type	Rod-type	Rod-type	Rod-type	Vert. 4 post guide type.			Horiz.	Rod	Rod
Press capacity, tons: Compression	100	150	200	300	12.5**	28**	38**	12.5**	50	300
Transfer	25	32	40	60					19	70
Molding or working area,## sq. in.	- - -	- - -	- - -	- - -	1,032	2,184	2,856	1,024	288	1,024
Ram or plunger: Stroke, inches	Ram 24, plunger 11				24	40	24 - 40*	24	12:10 (T)	18:15 (T)
Opening	- - -	- - -	- - -	- - -	6	7	12	12	28	48
Speeds, inches/minute: Closing	435	435	468	456	160	160	160	160	290	230
Opening	408	325	360	360	160	160	160	160	290	244
Clamping	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressing###	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	20 max.*	10 max.*
Platens or molds: Max. size, inches	24 x 20	24 x 20	30 x 24	36 x 30	24 x 43	42 x 52	42 x 68	32 x 32	18 x 16	36 x 32
Number of platens	2	2	2	2	2	2	2	2	2	2
Max. daylight opening, in.	38	38	38	42	- - -	- - -	- - -	- - -	28	48
Clamping force, tons	100	150	200	300	12.5	28	38	12.5	19	70
###Thickness (min.-max.), in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter, in.	3½	4	5	6	- - -	- - -	- - -	- - -	- - -	- - -
Space between, inches	24 x 20	24 x 20	30 x 24	36 x 30	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Electric	Electric	Electric	Electric	Steam	Steam	Steam	Steam	Optional	Optional
Motor hp.	15	20	20	30	Varies with type of hydraulic system.				5	15
Approx. floor space (LxW), feet	10 x 8½	10 x 8½	10-2/3 x 9-1/2	11-1/3 x 10-1/3	4 x 6	4½ x 8	6 x 8	4 x 10	4-1/3x1½	5-2/3 x 2-5/6
Special features	Positive top & bottom ejection; indep. air hold-up or hold-down; insul. platens; integral part unloader; hi-speed approach; adj. low-pressure close; oil cooler.				Designed & programmed for molding expendable polystyrene.				Auto. cycle controller. Standard breathing. Top and bottom ejection.	
Optional features	Fully-adjustable breathe cycles; indicating temperature controls for platens; fully automatic preform heater & feeder.				Other programs to special order. Auto. feeder. Hydr. power unit.				Steam or electric mold heating. Hydr. ejection. Low-press. controls for clamp & transfer circuits.	
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	6 - 8	6 - 8	6 - 8	6 - 8	- - -	- - -

* As ordered.
** Holding type

* Adjustable.

Manufacturer*	Stokes # (Cont'd.)		Wabash			
Model number	800	741	12-10	30-12	50-15	100-24
Machine action	Auto.	Auto.	Manual	Manual or semi-auto.		Semi-auto.
Machine design type	Rod	Rod	Rod	Rod	Rod	Rod
Press capacity, tons: Compression	25	50	12	30	50	100
Transfer	- - -	- - -	- - -	- - -	- - -	- - -
Molding or working area,## sq. in.	60	195	70	144	180	576
Ram or plunger: Stroke, inches	5	12	6	6	7	7
Opening	17-20-3/4	28	10	10	15	15
Speeds, inches/minute: Closing	600	300	Manual	- - -	1	1
Opening	600	300	Manual	- - -	18	18
Clamping	- - -	- - -	- - -	- - -	- - -	- - -
Pressing###	10 max.*	27 max.*	- - -	- - -	- - -	- - -
Platens or molds: Max. size, inches	10 x 6	15 x 13	7 x 10	12 x 12	12 x 15	24 x 24
Number of platens	2	2	2	2	2	2
Max. daylight opening, in.	17-20-3/4	28	22	22	24	24
Clamping force, tons	- - -	- - -	- - -	- - -	- - -	- - -
###Thickness (min.-max.), in.	- - -	- - -	- - -	- - -	- - -	- - -
Posts, tie bars, or rods: Diameter, in.	1½	2½	1½	1½	1-3/4	2
Space between, inches	14-3/4 x 5-1/4	19 x 11½	10	12	15	24
Type of heating	Electric	Electric	Electric or steam.			
Motor hp.	2	5	- - -	3/4	3/4	1
Approx. floor space (LxW), feet	2 x 5	4 x 10	1 x 1	2 x 2	2 x 2	2½ x 2½
Special features	Top & bottom ejection. Sequence control. Low pressure closing. Double-shot protection.		Laboratory presses.			
	Breathe attachment.	Preset loading boards.				
Optional features	Powder preheating.		- - -	- - -	- - -	- - -
Approx. delivery time, weeks	2 - 4	2 - 4	4	4	6	10 - 12

* Adjustable.

Ketchpel Engineering Co.

Makes C-frame 15-ton hydraulic press.

Miller & Van Winkle Co.

Makes a semi-auto., horizontal press for molding expanded polystyrene.

Pasadena Hydraulics, Inc.

In addition to bench-type & floor-model units, also make transfer presses, and custom-made presses to 600 tons.

Taccone Corp.

Compression, transfer, reinforced-plastics molding, and laminating presses made to customers' specifications; both automatic and semi-automatic in operation.

Tronomatic Mfg. Corp.

Custom sizes for molding expanded styrene beads.

Custom-Made To Order

Adamson United Co.

Designers and builders of special compression and transfer presses from 50 tons and up in capacity. All standard and special types included.

Atlas Hydraulics Div., Delaware Valley Mfg. Co.

In addition to tabulated models, designs and builds custom presses for extremely accurate molding, laminating, & special applications with characteristics to meet requirements.

Stewart Bolling & Co., Inc.

Compression and transfer presses to customers' specifications can be furnished.

Dake Corp.

Guided-platen compression and transfer presses in capacities from 25-600 tons.

Dunning & Boschert Press Co., Inc.

Semi-auto. presses made in ram sizes from 8-24 inches, with tonnages (at 3,000 psi. line pressure) from 75-679. Optional features include transfer cylinders, top and bottom ejection, steam or electric heating, and degassing.

Erie Engine & Mfg. Co.

Compression, transfer & laminating presses available in all standard sizes and design types which can be modified to meet specific requirements. Made in manual & semi-auto. types which can be equipped with pull-back or push-back cylinders.

Erie Foundry Co.

Presses & design types available up to 2M tons.

French Oil Mill Machinery Co.

Semi-auto., & manual compression & transfer molding presses made in rod-type & side-plate designs in capacities from 30-2,000 tons, either self-contained or accumulator-operated.

Hull Corp.

In addition to tabulated models, also makes special molding presses in sizes from 10-500 tons.

Hydraulic Press Mfg. Co.

In addition to tabulated models, also builds larger presses to customers' specifications. Also makes special loaders & other auxiliary equipment to order.

(Continued in 1st column on left)

PT's Classified List of Auxiliary Equipment for Thermoforming and Compression and/or Transfer Molding

Accumulators

Adamson United Co., 730 Carroll St., Akron 4, Ohio
Airmatic Valve, Inc., 7313 Associate Ave., Cleveland 9, Ohio
Baldwin-Lima-Hamilton Corp., Hamilton Div., Hamilton, Ohio
Blaw-Knox Co., 300 Sixth Ave., Pittsburgh 22, Pa.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, N.Y.
Elmes Engineering Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farrel-Birmingham Co., Inc., Ansonia, Conn.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Greer Hydraulics, Inc., N.Y. International Airport, Jamaica 30, New York
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
Lake Erie Machinery Corp., P.O. Box 68, Buffalo 17, N.Y.
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Miller Fluid Power Div., Flick-Reedy Corp., 7N015 York Rd., Bensenville, Ill.
Mount Hope Machinery Co., 15 Fifth St., Taunton, Mass.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.
Waldron-Hartig Div., Midland-Ross Corp., P.O. Box 791, River Rd., New Brunswick, N.J.

Barrels, Tumbling

Abbe Engineering Co., 420C Lexington Ave., New York 17, N.Y.
Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers 2, New York
Continental Machinery Co., Inc., 261 Broadway, New York 7, New York
Crown Machinery, Inc., 2721 S. San Pedro St., Los Angeles 11, Calif.
Ferry Machine Co., W. Main St. Ext., Kent, Ohio
Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio
H. W. Kramer Co., Inc., 120-130 Jamaica Avenue, Richmond Hill 18, N.Y.
Lord Chemical Corp., 2068 S. Queen St., York, Pa.
Lupoline Automatic Polishing Equipment Corp., 4510 Bullard Ave., Bronx 70, N.Y.
Morse Mfg. Co., Inc., 727 W. Manlius St., E. Syracuse, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, New York
Rampe Mfg. Co., 14915 Woodworth Avenue, Cleveland 10, Ohio
Ransohoff Co., N. 5th St. & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tower Iron Works, Inc., 50 Borden St., Providence, R.I.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.

Controlling Instruments, Press Cycling

Eagle Signal Corp., 202-20th St., Moline, Ill.
Electronic Process Corp. of California, 436 Bryant, San Francisco 7, Calif.
Foster & Allen, Inc., 26 Commerce St., Chatham, N.J.
The Foxboro Company, 38 Neponset Ave., Foxboro, Mass.
GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Glenn Electric Heater Corp., 372 Jelliff Ave., Newark 8, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis 8, Minn.
Partlow Corporation, 225 Campion Rd., New Hartford, N.Y.
Plastics by Chapmann, 1220 S. 49th St., Richmond, Calif.
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Taylor-Emmett Controls, Inc., 445 E. Turkeyfoot Lake Rd., Akron 19, Ohio
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
Wallace & Tiernan, Inc., 25 Main St., Belleville 9, N.J.
G. C. Wilson & Co., 1915 Eighth Ave., Huntington, W. Va.

Controlling Instruments, Pressure

Fischer & Porter Co., Countyline Rd., Warminster, Pa.
The Foxboro Co., 38 Neponset Ave., Foxboro, Mass.
GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.
Gabriel Mfg. Co., 15 Maple Ave., Haverstraw, N.Y.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Helicoid Gage Div., American Chain & Cable, 929 Connecticut Ave., Bridgeport 2, Conn.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.
Leslie Co., 214 Leslie Bldg., Lyndhurst, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis 8, Minn.
Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
United Electric Controls Co., 85 School St., Watertown 72, Mass.
Weston Instruments, Div. of Daystrom, Inc., 614 Frelinghuysen Ave., Newark 12, N.J.

Controlling & Indicating Instruments, Temperature

Barber-Colman Co., Wheelco Instruments Div., 1300 Rock St., Rockford, Ill.
Curtiss-Wright Corp., Princeton Division, Princeton, N.J.
Electric Auto-Lite Co., General Products Group, Champlain, Toledo 1, Ohio
Electronic Processes Corp. of California, 436 Bryant, San Francisco 7, Calif.
Fenwal, Inc., Pleasant St., Ashland, Mass.
Fischer & Porter Co., Countyline Rd., Warminster, Pa.
The Foxboro Co., 38 Neponset Ave., Foxboro, Mass.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Glenn Electric Heater Corp., 372 Jelliff Ave., Newark 8, N.J.
Industrial Mfg. Corp., 31 E. Georgia St., Indianapolis 4, Ind.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.
Leslie Co., 214 Leslie Bldg., Lyndhurst, N.J.
Mayer Refrigerating Engineers, Inc., Boonton Turnpike, Lincoln Park, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., S., Minneapolis 8, Minn.
Partlow Corp., 225 Campion Rd., New Hartford, N.Y.
The Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
Pyrometer Instrument Co., Inc., 92 Portland St., Bergenfield, N.J.
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Sarco Co., Inc., 635 Madison Avenue, New York 22, N.Y.
Sterling, Inc., 520 W. Clinton Ave., Milwaukee, Wis.
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
Thermo Electric Co., Inc., 109 Fifth St., Saddle Brook, N.J.
Thwing-Albert Instrument Co., 5398 Pulaski Ave., Philadelphia 4, Pa.
United Electric Controls Co., 85 School St., Watertown 82, Mass.
West Instrument Corp., 4263 W. Montrose Ave., Chicago 41, Ill.

Cylinders, Hydraulic

Airmatic Valve, Inc., 7313 Associate Avenue, Cleveland 9, Ohio
Airoyal Mfg. Co., 1990 Springfield Avenue, Maplewood, N.J.
Automatic Process Control, 1170 Morris Avenue, Union, N.J.
The Bellows Co., 230 West Market St., Akron 9, Ohio
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Dake Corporation, 641 Robbins Road, Grand Haven, Mich.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, N.Y.
The French Oil Mill Machinery Co., 1040 West Greene St., Piqua, Ohio
Hanna Engineering Works, 1767 Elston Ave., Chicago 22, Illinois
Hannifin Co., Div. of Parker-Hannifin Corp., 554D S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Marion Rd., Mt. Gilead, Ohio
Independent Machine Co., Munroe Falls Ave., Cuyahoga Falls, Ohio
Lapeer Mfg. Co., 1149 W. Baltimore St., Detroit 2, Michigan
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Lempco Industrial, Inc., 5490 Dunham Rd., Bedford, Ohio
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Miller Fluid Power Div., Flick-Reedy Corp., 7N015 York Rd., Bensenville, Ill.
The Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wisconsin
Rodgers Hydraulic, Inc., 7401 Walker St., Minneapolis 26, Minn.
Valvair Corp., 220 W. Market St., Akron 3, Ohio

Deflashing Machines

Anson Tools & Gages, Inc., 1504 W. 12th Street, Erie, Pa.
Buttondex Corporation, 386 Fourth Avenue, New York 16, N.Y.
Falls Engineering & Machine Co., 1734 Front St., Cuyahoga Falls, Ohio
Ferry Machine Co., West Main Street Extension, Kent, Ohio
Foredom Electric Co., Inc., Bethel, Connecticut
Gaynes Engineering Co., 1642 W. Fulton St., Chicago 12, Ill.
Ketchpel Engineering Co., 1401-04 Palisade Avenue, W. Englewood, N.J.
H. W. Kramer Co., Inc., 120-30 Jamaica Avenue, Richmond Hill 18, N.Y.
Lord Chemical Corp., 2068 S. Queen St., York, Pennsylvania
Lupoline Automatic Polishing Equipment Corp., 4510 Bullard Ave., Bronx 70, N.Y.
Merit Products, Inc., 3691 Lenawee Ave., Los Angeles 16, Calif.
J. M. Nash Co., Inc., 2360 N. 30th St., Milwaukee 45, Wis.
Ransohoff Co., N. 5th St. & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.

Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.
Wheelabrator Corporation, 1414 S. Byrkit St., Mishawaka, Ind.

Degating Equipment

Anson Tools & Gages, Inc., 1504 W. 12th Street, Erie, Pa.
Barker-Davis Machine Co., Inc., 91 Mechanic Street, Leominster, Mass.
Buss Machine Works, Inc., 300 Eighth St., Holland, Michigan
Buttondex Corporation, 386 Fourth Avenue, New York 16, N.Y.
Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Plastic Molders Supply Co., Inc., 74 South Avenue, Fanwood, N.J.
Standard Tool Co., 203 Hamilton Street, Leominster, Mass.
Sta-Warm Electric Co., 858 N. Chestnut Street, Ravenna, Ohio
Stricker-Brunhaber Corp., 19 West 24th St., New York 10, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.

Dies, Cutting

A & S Steel Rule Die Corp., 195 Chrystie St., New York 2, N.Y.
Able Steel Rule Die Co., 65 Bleecker St., New York 12, N.Y.
Accurate Steel Rule Die Mfrs., 22 West 21st St., New York 10, N.Y.
Akron Presform Mold Co., 2038 Main St., Cuyahoga Falls, Ohio
Atlas-Sandt Corp., 240-42 West 23 St., New York 11, New York
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pennsylvania
Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pennsylvania
Entoleter Div., Safety Industries, Inc., 1187 Dixwell Ave., New Haven, Conn.
Falls Engineering & Machine Co., 1734 Front Street, Cuyahoga Falls, Ohio
G & S Label Corp., 49 West 27 Street, New York 1, N.Y.
Independent Die & Supply Co., 2641 La Salle St., St. Louis 4, Mo.
Lansky Die Cutting Corp., 473 President Street, Brooklyn 15, New York
Payne Tool & Engineering Co., 1300 W. Columbia St., Springfield, Ohio
J. A. Richards Co., 903 N. Pitcher St., Kalamazoo, Mich.
S. Todaro Co., 52 Trinity Place, Buffalo 1, N.Y.
Tronomatic Machine Mfg. Corp., 1881 Park Avenue, New York 35, N.Y.
United Shoe Machinery Corp., 140 Federal St., Boston 7, Mass.
Western Supplies Co., 2920 Cass Avenue, St. Louis 6, Mo.

Heating Equipment for Molds

American Hydrotherm Corp., 10-55 Jackson Ave., Long Island City 1, New York
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pa.
E. B. Blue Co., 651 Connecticut Avenue, S. Norwalk, Conn.
Briscoe Mfg. Co., 1055 Gibbard Ave., Columbus 3, Ohio
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Conapac Corp., 120 East 13 St., New York 3, N.Y. (U.S. & Canadian Dist. for Hydro-Chemie Ltd.)
D. C. Cooper Co., 1467 S. Michigan Ave., Chicago 5, Ill.
Dean Therom-Panel Coil Div., Dean Products, Inc., 616 Franklin Ave., Bklyn. 38, N.Y.
Devco Engineering, Inc., Peir Lane, W. Caldwell, N.J.
Electric Trading Co., 313-315 Canal St., New York 13, N.Y.
Erinac Equipment Corp., 225 Lafayette St., New York 12, N.Y.
Falcon Equipment Co., 13th Street, New Brighton, Pa.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Gerin Mfg. Inc., 683-685 N. 5th St., Newark 7, N.J.
Glenn Electric Heater Corp., 372 Jelliff Avenue, Newark 8, N.J.
Grieve-Hendry Co., Inc., 1401 W. Carroll Ave., Chicago 7, Ill.
Guild Electronics, Inc., Dynatherm Div., 388 Broadway, New York 13, N.Y.
Hotwatt, Inc., 75 Maple St., Danvers, Mass.
Improved Machinery, Inc., 150 Burke St., Nashua, N.H.
Industrial Heater Co., Inc., 417 Canal St., New York 13, N.Y.
Industrial Mfg. Corp., 31 E. Georgia St., Indianapolis 4, Ind.
Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio
Mercury Molding Machinery, Inc., 972 Nepperhan Ave., Yonkers, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Pantex Mfg. Corp., 520 Roosevelt Ave., Pawtucket, R.I.
Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
The Rainville Co., Inc., 657 Franklin Avenue, Garden City, New York
Robbins Plastic Machinery Corp., 1430 Mishawaka St., Elkhart, Ind.
W. S. Rockwell Co., 20 Elliot St., Fairfield, Conn.
Sterling, Inc., 5200 W. Clinton Avenue, Milwaukee, Wis.
Thermel, Inc., 9400 Robinson Rd., Franklin Park, Ill.

Marking Equipment

The Acromark Co., 5-13 Morrell St., Elizabeth 4, N.J.
Defiance Machine & Tool Co., 1920 S. Vandeventer Ave., St. Louis 10, Mo.
Halvorfold Kwikprint Co., 700 E. Union, Jacksonville, Fla.
James H. Matthews & Co., 3829 Forbes Ave., Pittsburgh 13, Pa.
Olsenmark Corp., 124-132 White St., New York 13, N.Y.
Peerless Roll Leaf Co., Inc., 4511 New York Ave., Union City, N.J.
Skyline Industries, Titusville, Pa.

Metal Detectors and Separators

Allis-Chalmers Mfg. Co., 864 South 70th St., Milwaukee 1, Wisc.
E. W. Brilmayer Laboratories, Inc., 86 Fulton St., New York 38, N.Y.
Carpco Mfg. Inc., 4120 Haines St., Jacksonville 6, Florida
Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pa.
Eriez Mfg. Co., 7 E. 12th St., Erie, Pa.
Magnetic Engineering & Mfg. Co., 851 Van Houten Ave., Clifton, N.J.
Plastic Molders Supply Co., Inc., 74 South Avenue, Fanwood, N.J.
Radio Corp. of America, Front & Cooper Sts., Camden 2, N.J.
Rainville Co., Inc., 657 Franklin Avenue, Garden City, N.Y.

Mold Chillers

Al-Be Industries, 9516 Rayo St., South Gate, Calif.
Anson Tools & Gages, Inc., 1504 W. 12th St., Erie, Pa.
Artisan Metal Products, Inc., 63 Pond Street, Waltham 54, Mass.
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pa.
Dean Thermo-Panel Coil Div., Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N.Y.
Frank W. Egan & Co., 671 S. Adamsville Rd., Somerville, N.J.
Electric Trading Co., 313-315 Canal St., New York 13, N.Y.
Gerin Mfg. Co., Inc., 683-685 N. 5th St., Newark 7, N.J.
Goulding Mfg. Co., 2929 River St., Saginaw, Mich.
Industrial Ovens, Inc., 13825 Triskett Rd., Cleveland 11, Ohio
Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio
L & P Tool Co., 2861 Sidney Ave., Cincinnati 25, Ohio
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Liberty Machine Co., Inc., 275 Fourth Avenue, Paterson 4, N.J.
Mayer Refrigerating Engineers, Inc., Boonton Turnpike, Lincoln Park, N.J.
Mercury Industries, Inc., 365 Broadway, Hillsdale, N.J.
Mercury Molding Machinery, Inc., 972 Nepperhan Avenue, Yonkers, N.Y.
Modern Plastic Machinery Corp., 15 Union St., Lodi, N.J.
Motch & Merryweather Machinery Co., 1258 E. 22nd St., Cleveland 17, Ohio
National Rubber Machinery Co., Plastics Machinery Div., 47 W. Exchange St., Akron 8, Ohio
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Pecorp, Inc., Basin Rd., P.O. Box 3164, Wilmington 4, Del.
The Rainville Co., Inc., 657 Franklin Ave., Garden City, N.Y.
Saren, Inc., 816 N. Kostner Ave., Chicago 51, Ill.
T. Shriver & Co., Inc., 808 Hamilton St., Harrison, N.J.
Sterling, Inc., 5200 W. Clinton Ave., Milwaukee, Wis.
Tenney Engineering, Inc., 1090 Springfield Rd., Union, N.J.
John Verduin Machine Corp., 345-357 Tenth Avenue, Paterson 4, N. J.
Vic Mfg. Co., 1313 Hawthorne Ave., Minneapolis, Minn.
John Waldron Corp., P.O. Box 791, River Rd., New Brunswick, N.J.
Wilkinson Co., 619 E. Tallmadge Ave., Akron 10, Ohio

Mold Components, Standard

Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pa.
Damen Tool & Engineering Co., Inc., 4621-4627 N. Olcott Ave., Chicago 31, Ill.
Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit, Mich.
National Tool & Mfg. Co., 100 N. 12th St., Kenilworth, N.J.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
The Van Dorn Iron Works Co., 2685 East 79th St., Cleveland, Ohio

Molds

ABA Tool & Die Co., Inc., 1395 Tolland Turnpike, Manchester, Conn.
Akron Presform Mold Co., 2038 Main St., Cuyahoga Falls, Ohio
Astor Tool & Die Co., 5-01 47th Rd., Long Island City 1, N.Y.
B & E Electroform Co., Greely Ave., Union, N.J.
Bart Manufacturing Corp., 227 Main St., Belleville 9, N.J.
Beacon Die-Mold Inc., 57 Crooks Ave., Clifton, N.J.
Blackhawk Molding Co., Inc., Commercial Road, Addison, Ill.
Conforming Matrix Corp., Toledo Factories Bldg., Toledo 2, Ohio
Damen Tool & Engineering Co., Inc., 4621-4627 N. Olcott Ave., Chicago 31, Ill.
Electroforms, Inc., 239 E. 165 St., Gardena, Calif.
Electromold Corporation, 140 Enterprise Ave., Trenton 9, N.J.
Geneve Mfg. Corp., 288 Third St., Trenton, N.J.
Hartland Plastics Inc., 340 Maple Avenue, Hartland, Wis.
T. V. Jay Co., 2227 W. Belmont Ave., Chicago 18, Ill.
Liberty Tool & Machinery Co., 18 S. 20th St., Irvington 11, N.J.
Ernest Mueller, 125 N. Detroit St., Los Angeles 36, Calif.
Oak Engineering Co., Inc., 110 Monmouth St., Gloucester City, N.J.
Pasley's Plastic Products, Inc., 1275 Ellsworth Industrial Dr., N.W., Atlanta 18, Ga.
Planet Plating Co., Inc., 494 Morgan Ave., Brooklyn 22, N.Y.
Plastic Mold Tool & Die Co., Inc., 1 Maple Street, E. Rutherford, N.J.
Plastiplate Co., Inc., 7-9 Holmes Ave., South River, N.J.
Plating Engineering Co., 1928 S. 62nd St., Milwaukee 19, Wis.
Reinhardt Plastics Co., 1611-15 Platte St., Denver 2, Colo.
Rochelle Plastic Mold Co., Inc., 35 Sebago St., Clifton, N.J.

J. C. Tilp, Inc., Springfield & Miltown Rds., Union, N.J.
Sawaya Mfg. Co., Inc., 305 State St., Trinidad, Colo.
Sierra Electric Corp., 15100 S. Figueroa, Gardena, Calif.
Stokes-Trenton, Inc., 150 Enterprise Ave., Trenton 9, N.J.
Timely Products Co., 308 Rogers Rd., Des Moines 15, Iowa
Ultra Electroforming & Mfg., 110 Cedar Ave., Pitman 7, N.J.

Motors

Allis-Chalmers Mfg. Co., 1163 S. 70th St., Milwaukee 1, Wis.
General Electric Co., Apparatus Sales Div., 1 River Road, Schenectady 5, N.Y.
Induction Motors Corp., 570 Main Street, Westbury, New York
Modern Plastic Machinery Corp., 15 Union St., Lodi, N.J.
The Oilgear Co., 1560 Pierce St., Milwaukee 4, Wisconsin
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22, Calif.

Platens, Press

Adamson United Co., 730 Carroll Street, Akron 4, Ohio
P. E. Albert & Son, 21 Nottingham Way, Trenton 3, N.J.
Atlantic Mfg. Co., Ninth & Master Streets, Philadelphia 22, Pa.
Baldwin-Lima-Hamilton Corp., Philadelphia National Bank Bldg., Philadelphia 7, Pa.
Berthelsen Engineering, P.O. Box 1423, Joliet, Illinois
Birdsboro Steel Foundry & Machine Co., 1951 Furnace St., Birdsboro, Pa.
E. W. Bliss Co., 1375 Raff Road, S.W., Canton 10, Ohio
Bolling, Stewart & Co., Inc., 3190 E. 65th Street, Cleveland 27, Ohio
Fred S. Carver, Inc., 1 Chatham Rd., Summit, N.J.
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Custom Engineering Co., 2414 McKinley Ave., Erie, Pa.
Dake Corp., Grand Haven, Mich.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, N.Y.
Elmes Engineering Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
Falcon Equipment Co., 13th St., New Brighton, Pa.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Johnson Machinery Co., 90 Elizabeth Ave., Elizabeth, N.J.
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
Lake Erie Machinery Corp., P.O. Box 68, Buffalo 17, N.Y.
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Lempco Industrial, Inc., 5490 Dunham Rd., Bedford, Ohio
The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
M & N Hydraulic Press Co., Inc., P.O. Box 504, Clifton, N.J.
Pasadena Hydraulics, Inc., 1433 Lidcombe, El Monte, Calif.
Plastic Laminating Corp., 2087 Springfield Ave., Vauxhall, N.J.
Reliable Rubber & Plastic Machinery Co., Inc., 2014 Union Turnpike, N. Bergen, N.J.
Roehlen Engraving Works, 324 St. Paul St., Rochester 5, N.Y.
Ralph B. Symons Associates, Inc., 3571 Main Road, Tiverton, R.I.
Thermel, Inc., 9400 Robinson Rd., Franklin Park, Ill.
John Verduin Machine Corp., 345-357 Tenth Avenue, Paterson 4, N.J.
Willson Camera Co., 1395 Lawrence Rd., Havertown, Pa.
R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Power Systems, Hydraulic

Berthelsen Engineering, P.O. Box 1423, Joliet, Ill.
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Consolidated Baling Machine Co., 408-L Third Avenue, Brooklyn 15, N.Y.
Continental Machinery Co., Inc., 261 Broadway, New York 7, N.Y.
Dake Corp., 641 Robbins Rd., Grand Haven, Mich.
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
The French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
GPE Controls, Inc., 240 E. Ontario St., Chicago 11, Ill.
Goulding Mfg. Co., 2929 River St., Saginaw, Michigan
Greer Hydraulics, Inc., N.Y. International Airport, Jamaica 30, N.Y.
Hannifin Co., Div. of Parker-Hannifin Corp., 554D S. Wolf Rd., Des Plaines, Ill.
Guy P. Harvey & Son Corp., 40 Spruce St., Leominster, Mass.
Hull Corp., Hatboro, Pa.
The Hydraulic Press Mfg. Co., Marion Rd., Mt. Gilead, Ohio
Johnson Machinery Co., 90 Elizabeth Ave., Elizabeth, N.J.
Kabar Mfg. Corp., 1907 White Plains Rd., New York 62, N.Y.
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Logan Hydraulics Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Mayflower Electronic Devices Inc., 20 Industrial Ave., Little Ferry, N.J.
The Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Possis Machine Corp., 1645 Hennepin Ave., Minneapolis 3, Minn.
Racine Hydraulics & Machinery, Inc., 2000 Albert St., Racine, Wis.
Rodgers Hydraulic Inc., 7401 Walker St., Minneapolis 26, Minn.
Stanford Engineering Co., Box 329, Salem, Ill.
Ralph B. Symons Assoc. Inc., 3571 Main Road, Tiverton, R.I.
R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Preformers

The Bonnot Co., 722 Mulberry Ave., S.E., Canton 2, Ohio
Arthur Colton Co., Div. of Snyder Corp., 3400 E. Lafayette St., Detroit 7, Mich.
Logan Hydraulics Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Rodgers Hydraulics Inc., 7401 Walker St., Minneapolis 16, Minn.
F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.

Preheating Equipment

Allis-Chalmers Mfg. Co., 1163 S. 70th St., Milwaukee 1, Wis.
D. C. Cooper Co., 1467 S. Michigan Avenue, Chicago 5, Ill.
Faratron, 447 Union Pacific Avenue, Los Angeles 23, Calif.
Girdler Process Equipment Div., Chemetron Corp., 334 E. Broadway, Louisville 1, Ky.
Guild Electronics Inc., Dynatherm Div., 388 Broadway, New York 13, N.Y.
W. T. La Rose & Assoc., Inc., Troy, New York
Mayflower Electronic Devices, Inc., 20 Industrial Avenue, Little Ferry, N.J.
Radio Frequency Co., Inc., 44 Park Ave., Garden City, N.Y.
The Rainville Co., Inc., 657 Franklin Ave., Garden City, N.Y.
Raybond Electronics, Inc., 66 Needham Street, Newton 61, Mass.
Reeve Electronics, Inc., 609 West Lake St., Chicago 6, Ill.
Sealomatic Electronics Corp., 429 Kent Avenue, Brooklyn 11, New York
Sherman Industrial Electronics, 601 West College Avenue, Box 813, State College, Pa.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.
The Thermatron Co., Div. of Willcox & Gibbs Sewing Machine Co., 214 W. 39 St., New York 18, N.Y.
Timadco, Inc., 72 Jericho Turnpike, Mineola, New York
Weldotron Corp., 841 Frelinghuysen Ave., Newark 12, N.J.
Young Bros. Co., 1823 Columbus Road, Cleveland 13, Ohio

Pulverizing Units

Paul O. Abbe, Inc., 257 Center Ave., Little Falls, N.J.
American Pulverizer Co., 1249 Macklind Ave., St. Louis 10, Missouri
Custom Machine & Design, Inc., P.O. Box 1064, 200 S. Forge St., Akron 9, Ohio
Entoleter Div., Safety Industries, Inc., 1187 Dixwell Ave., New Haven, Conn.
Ferro Corp., Patterson Equipment Div., E. Liverpool, Ohio
First Machinery Corp., 209-289 — 10th St., Brooklyn 15, N.Y.
Johnson Machinery Co., 90 Elizabeth Ave., Elizabeth, N.J.
Franklin P. Miller & Son, Inc., 36 Meadow Street, E. Orange 16, N.J.
Munson Mill Machinery Co., 210 Seward Ave., Utica 1, N.Y.
Pulva Corp., 550 High St., Perth Amboy, N.J.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc., 30 Chatham Rd., Summit, N.J.
The Rainville Co., 657 Franklin Ave., Garden City, N.Y.
Charles Ross & Son Co., 148 Classon Ave., Brooklyn 5, N.Y.
Sturtevant Mill Co., 103 Clayton St., Boston, Mass.

Tables, Elevating

Adamson United Co., 730 Carroll Street, Akron 4, Ohio
Bolling, Stewart & Co., Inc., 3190 E. 65th St., Cleveland 27, Ohio
Clifton Hydraulic Press Co., 289 Alwood Rd., Clifton, N.J.
Economy Engineering Co., 4511 W. Lake St., Chicago 24, Ill.
Erie Engine & Mfg. Co., 953 East 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Hamilton Tool Co., 917 Hanover Street, Hamilton, Ohio
Lewis-Shepard Products, Inc., 125 Walnut Street, Watertown 72, Mass.
Mercury Industries, Inc., 365 Broadway, Hillsdale, N.J.

Tumbling Machines

Abbe Engineering Co., 420C Lexington Avenue, New York 17, N.Y.
Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers 2, N.Y.
Ball & Jewell, Inc., 24-28 Franklin St., Brooklyn 22, N.Y.
Crown Machinery, Inc., 2721 S. San Pedro St., Los Angeles 11, Calif.
Ferro Corp., Patterson Equipment Div., E. Liverpool, Ohio
Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio
H. W. Kramer Co., Inc., 120-30 Jamaica Ave., Richmond Hill 18, N.Y.
Lupoline Automatic Polishing Equipment Corp., 4510 Bullard Ave., Bronx 70, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Patterson-Kelley Co., Inc., E. Stroudsburg, Pa.
Rainco Mfg. Inc., R.D. #2, Franklin, Pa.
Ransohoff Co., North 5th Street & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.
Werner & Pfleiderer Corp., 500 Fifth Ave., New York 36, N.Y.
Wheelabrator Corp., 1414 S. Byrkit St., Mishawaka, Ind.

Casting polyurethane chairs

Sit up and look! Sit down and feel! An upholstered, all-urethane chair molded about a steel skeleton.

Perfection of a method for closed molding urethane foam may remove the last obstacle in this material's competition for the furniture market, one of the two major industries in which it has become a significant challenge to other materials. Developed by General Tire & Rubber Co. for Karpen Furniture, a division of Schnadig Corp., the process involves injecting foam-forming chemicals into a mold retaining a steel framework.

The furniture market is presently the largest consumer of urethane foam. It is easy enough to slice sections off a foam bun for use in throw cushions and square Scandinavian furniture. For upholstered furniture, however, it is necessary to cut the slab as close to size as possible. This gives not only rounded edges, but also large amounts of scrap. The end result costs almost as much trouble and money as the traditional animal hair or textile wadding.

Development of the Karpen-General Tire & Rubber process may eventually permit mass production of quality upholstered furniture. Here is the way the line of five chairs comprising Karpen's Chair-Foam Collection is made: At its Chicago headquarters, Karpen manufactures a tubular steel frame (Figure 2) for a given design. The frame is shipped to the Marion, Ind., plant of General Tire & Rubber Co., where engineers have built a mold for that particular design. Once the steel skeleton is positioned in the silicone-coated mold, the formulation—a liquid polyether, an isocyanate, an amine catalyst, and a fluorocarbon blowing agent—is injected. The mixture foams without addition of heat, completely enclosing the steel frame (Figure 3).

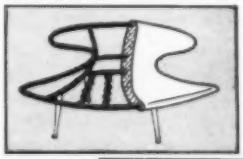
The cured casting (Figure 4) is returned to Chicago, where Karpen screws legs into the sockets (Figure 5) and glues fabric to the foam. Zippered or stitched upholstery may also be used.

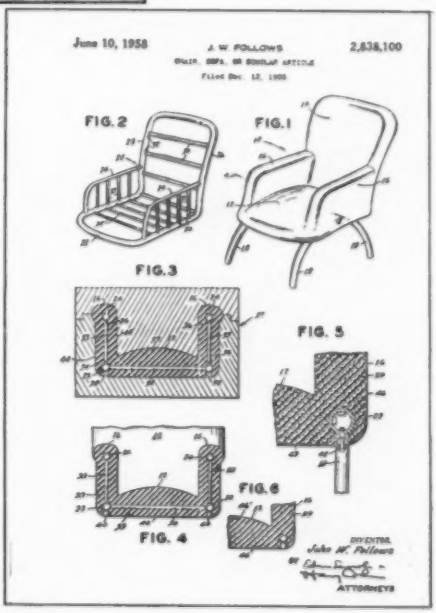
Loveseats, sofas, and other seating equipment may be fabricated similarly. Design possibilities are endless. The technique allows the use of varying foam thicknesses and complex contours. Density of the foam can be varied by choosing different grades of components. The foam chair above, one of the Karpen line, consists of a semi-rigid foam. For even greater seating comfort, a relatively flexible foam has been used for the detachable seat cushion.

The process is reminiscent of a technique for casting insulation around piping and valves. For this purpose, the equipment to be insulated is placed within a styrene or acrylic shroud. In the case of piping, this may be simply a rod extruded in a diameter larger than that of the pipe. The formulation is foamed in the cavity between the pipe and shroud, and after it has set, the release-coated tubing is stripped off.

Conventional foamed rubber is still the material in great demand for high-priced furniture; consumption of urethanes is 20-million pounds per year less. Use of rubber, however, is limited by its need of vulcanizing. It must either be used in slab form or molded to shape and fastened to wood frames. Further, urethanes have several physical characteristics superior to those of foamed rubber. The urethanes are tougher and lighter, and will not yellow with age.

Experimentation in foaming urethanes in closed molds has been underway for many years. This first commercial application involving the process should indicate whether quality urethane furniture can be mass produced, as well as provide incentive for use of similar techniques in other industries.





Technical aspects of molding acrylics

This second half of a two-part article begun in December discusses the actual techniques used to mold acrylics

J. F. MOORE*

Various formulations of Plexiglas and Implex have been discussed along with their physical characteristics, mold design, and preferred gating systems. Now, let us discuss some of the techniques involved in molding these materials, first defining the terms moldability and flow. They are often misinterpreted and transposed.

Flow is that property of a molding material determined by its melt viscosity at a given temperature. In order to fill a given mold under a given pressure, the melt viscosity of the material must be lower than a certain maximum value. In comparing various molding compounds, the one that will attain this necessary low viscosity at the lowest temperature is called the "easiest" or "softest" flow material.

Moldability, on the other hand, is a broad term denoting the latitude which a molding material permits in the setup of a molding machine to produce commercially acceptable parts. Good moldability implies a yield of satisfactory parts over a wide range of setup conditions, plus a lack of sensitivity to minor variations in pressure, cycle, and temperature.

The hygroscopic, or moisture absorption characteristics of acrylics are well known. A thoroughly predried molding powder will have at least a 40-60° F. wider molding range than a material having 0.3% moisture content. However, many molders do no predrying of acrylics, yet have low rejects for splash, blisters, and other effects of moisture content. This phenomenon is not a secret with these molders, but depends on the shot weight of the parts in relation to machine capacity. If a 4-ounce shot is molded in a 16-ounce machine it may be possible to reduce cylinder temperatures below the point where moisture becomes a serious problem. Conversely, if the shot weight is close to or above machine capacity, cylinder temperatures must be increased to a point where the moisture content will result in rejects for splash.

Packaging improvements such as heavy gage polyethylene liners allow delivery of molding materials with a much lower moisture content than the old asphalt barrier drum. These liners are also used in the 1,000-pound containers and super containers containing 4,000-pounds.

To demonstrate this more graphically, a drum of V-100 colorless material was stored purposely in a highly humid atmosphere for 90 days, after which the material was predried in an air circulating oven at 225° F. A standard hopper dryer, set at 120° F., was used on the molding machine during the trial run. The following reject rate for splash defect was noted: one hour predry, 65% rejects for splash; two hour predry, 33% rejects for splash; four hour predry, 14% rejects for splash; and seven hour predry, 3% rejects for splash.

The test was conducted while molding a flat dial, 6 by 15 by 0.05-inch thick-single gated, which is the most difficult type of part to mold from a splash standpoint. It was also found that a 1½-inch injection plunger cushion will eliminate splash caused by trapped air. It is believed the larger quantity of cold or cool material at the back of the cylinder vents out the air which might be trapped when the plunger moves forward.

Temperatures

There is no question that hot molds produce parts

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with improved physical properties. These temperatures should range from 120° F. for Grade 5 materials to 190° F. for Grade 8 materials. Mold temperatures are based on only one factor, however, the speed at which the cavity fills. There is a limit to the speed at which the acrylics can be shot. We have seen machines recently that will unload 12 pounds of general purpose styrene per second (preplasticized). Acrylics, when run on the same machines at the same shooting speeds, break down and produce a part with a completely frothed surface. The higher viscosity acrylics generate too much heat at this fill speed. Changing to a 4-second fill, we were able to produce parts with excellent finish. Average fill rate when molding acrylics should be more than 4 seconds and can range up to 40 seconds for a ½-inch thick viewer lens.

Slower injection fill time requires hotter molds due to the necessity of keeping the plastified material moving without splitting the plastic "envelope." If part design is such that a very rapid filling speed can be used, we see no valid reason to use a very hot mold. Lower mold temperatures result in cycle economies and better control over shrinkage values—if the part is to be decorated.

Instead of increasing pump speed to accomplish faster mold filling, we prefer to raise the rear cylinder zone temperature. The usual spread on a temperature profile would be in the range of 50-100° F., with the rear zone being the highest. The center zone should be set somewhere between the front and rear temperature, preferably closer to the lower front zone. We prefer to mold all acrylic formulations by this method.

Implex, on the other hand, molds better at moderate temperatures at a filling speed as fast as the plunger can travel, and at the maximum pressure available. It has been found that a reverse temperature profile, that is, a slightly higher front zone and lower rear zone will do several things for Implex finish. The cooler, higher inventory of pellets in the rear zone of the cylinder will vent off gases and trapped air which cause surface smears. Implex can be heated rapidly in the front heater zone and, as we pointed out, should be injected at the highest possible plunger speed and pressure. Small changes in pressure or speed will cause variations in the surface appearance. We also pointed out that submarine gates are preferred. Dispersion plates placed in the nozzle will break up the flow of the darker, more heavily pigmented materials and produce better finish. We prefer dispersion plates to dispersion nozzles since the natural stiffness of the material causes a too rapid pressure drop when passing through the small orifices of the dispersion nozzle.

Pressures

Injection pressures required to mold the acrylics are high, and we recommend 30,000 psi. pumps and clamp pressures in the range of 2½ tons per square inch (this may be a little on the high side). A soft flow material does not actually allow you to use lower clamp pressures just because it is soft in the same manner that flow material requires higher clamp pressures just because it is stiffer. We feel they all require the same clamping pressure because it is necessary to reduce the viscosity of the molding materials to a certain level in order to mold them properly. Softer materials require high clamping pressures because they flow easily and will flash the mold if clamp pressure is not maintained. The stiffer materials require high clamping pressures because of the need for higher cylinder heat.

Scrap and regrind

An important molding consideration is the usability of regrind. Here, acrylics stand out. If handled carefully, kept clean, and screened prior to reuse, second and third regrind will approximate virgin material in edge color and moldability. Removal of fines and dust content generated by the grinding of sprues, runners, and rejected parts by screening also removes a large percentage of air borne dust and dirt particles. It is very important to reduce the particles to a uniform size. Fines cause darkening of the polymer due to their rapid heat transfer in relation to a pellet or granule. A #12 stainless steel screen will remove the fines satisfactorily. This is a hand operation unless hooked up to the grinder.

Figure 16 shows a system of removing fines automatically—the "Handy Andy Fine Remover." It insures a virtually sealed system, screening small particles, dust and fines into a collecting bag which can be removed and emptied when necessary. It is useful with virgin materials to insure a tight system, free from outside dirt and air borne contamination. It also reduces oil, water, and dirt content from air loaders.

Production rates are affected greatly by fine content. A 24-hour run, made recently, on a difficult to operate mold proved this point. Using virgin Grade 8 molding compound as a control, we took back 1,000 pounds of regrind Grade 8 from a molder who does no screening and has a fairly high reject rate. We believed this to be caused primarily by the fine content in the regrind. The third phase of the test was to repelletize some of the regrind used in the second phase. The regrind pellets were produced by running all the material through our production pelleter.

We found the temperatures required for flash-free parts to be 456° F. for virgin material and pelletized regrind; 430° F. for untreated regrind. The presence of fines in the regrind forced a reduction of cylinder temperatures below normal in order to reduce the number of rejects caused by decomposition of the material. Note that merely repelletizing the regrind allowed a return to normal molding temperatures.

Maximum temperatures for blister-free parts were 450° F. for virgin material, 410° F. for regrind, and

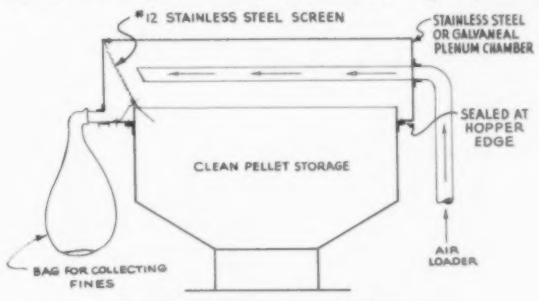


Fig. 16. Device for removing fines.

445° F. for pelletized regrind. Note again the necessity of reducing temperatures in order to mold acceptable parts, and again a return to normal temperatures when the repelleted material was used.

Maximum yield of defect parts was 57% for virgin, 13% for regrind, and 42% for pelletized regrind. These percentages, however, require further explanation. All commercially acceptable parts are not totally defect free. Tolerances are used and expected. The figures noted above were based on our opinion of perfect parts. Undoubtedly a higher percentage of parts would be acceptable for commercial use, but we do not feel the ratio would change very much. This run was made on a thin, single-gated part that is greatly affected by temperature drift and gate open time. These factors are controllable on our laboratory machines. We are not recommending that all of you have your regrind pelletized, but we do recommend eliminating the fines to produce a constant uniform granule size.

Let's discuss thickness in relation to the molding acrylics. Due to the nature of their view in comparison to general purpose styrene (which is about at the opposite ends of the scale), if the part under consideration is under 0.060-inch thickness, the styrene will cycle faster. This is due to its rapid fill characteristics and fluidity.

A cooler mold will freeze the material rapidly, resulting in shorter cycles. Conversely, if the part thickness is over 0.200-inch thick, the acrylic will cycle faster than styrene. At this thickness styrene will not set up rapidly in the mold, thus prolonging the cycle.

Actually, a part molded in acrylic with a projected area of 100 square inches will mold faster in a 0.125-inch thickness than the same part at 0.06-inch thickness. The thinner part requires higher cylinder temperatures, higher mold temperatures, and higher pressures—all of which prolong cycle time. Minimum thickness for molding Plexiglas is in the range of 0.06-inch. Due to its better flow, Implex can be molded down to a 0.04-inch thickness.

Figure 17 demonstrates a fairly simple method of controlling molding quality and size with multiple cavity molds. It consists of an engraved "ruler" adjacent to the base of the sprue bushing and is, in effect, a built-in "pressure gage." It should be 3½ inches long, ¼-inch wide, and 0.05-inch thick for Plexiglas; 0.03-inch thick for Implex. Numerals are engraved, 1-15, spaced ¼-inch apart. When the mold is first tried out, careful records should be kept as to the number reached on the gage in relation to part size and quality.

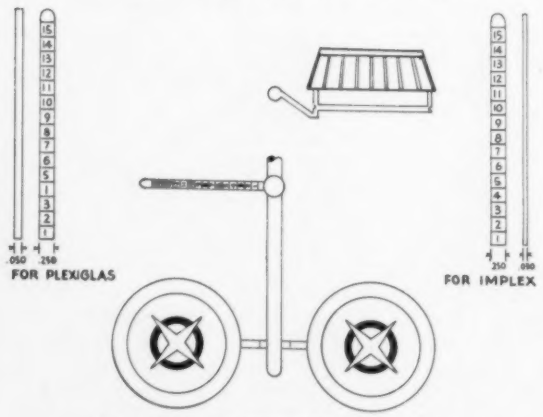


Fig. 17. Pressure gage set-up for acrylics.

In production, all parts filled to the correct degree (as determined by the gage) will be uniform in size and shape. The molding machine operator need only look at the number of the gage when inspecting the parts. Molding precise parts such as fountain pen barrels where thread size is so important, and decorated parts where mask fit is vital has proved the value of this simple tool.

Gating and de-gating

Very often gate location and part appearance after degating are cause for contention between molder and end user. The end user naturally expects the impossible in appearance since he is accustomed to buying metal and wood parts without a gate blemish and with uniform finish. The gate has been a source of trouble since injection molding began.

Ordinary clipping operations leave a lot to be desired from an appearance standpoint—particularly with fractured gates. The degree of fracture present depends on the surface temperature of the molded part at the time it is degated. Almost without fail, rigid plastic parts that are clipped are easily broken—generally in the gate area.

Degating systems should operate easily, with the best finish obtainable, and preferably without fracturing. Also, degating must fit within the time cycle of the molding operation.

The normal procedure, when operating a tab gated mold, is for the operator to break the gate at the tab area, leaving the tab attached to the molded part. It is difficult to clip the tab from the molded part, as it is usually ⅜-inch wide and an average of 0.1-inch thick. It has been found that a steel slitting saw, operating at 3,650 rpm. on a standard table saw, will degate the tab with a smooth, notch-free finish. The saw is 0.02-inch thick, having 25 teeth per inch without rake or set-in teeth. These saws are available in several diameters from 1-6 inches.

Thin slitting saws are not suitable for degating flash-gated parts since they generate too much heat in such insulating materials as plastics. These gates are thin in cross section, but generally quite long. A hot blade or hot knife (about 275° F.) mounted on a drill or arbor press will remove the flash gate evenly and with good finish.

The blade should be flat on one side with the opposite side being ground to a 10° angle. Heater bands are wrapped around the shank of the blade or cartridge heaters are inserted in drilled holes in the blade. A gate 40 mils thick can be removed in a few seconds with this device. The contact block should be aluminum or some other soft metal to prevent dulling of the sharp edge of the blade as it passes through the plastic. A rheostat should be used to control the blade temperature.

The ultimate, of course, is the submarine gate when molding Implex. Every time the mold opens a finished part is produced, free from surface smears, gates, and fractured edges.

Here is an empirical formula for determining cycle time versus thickness and area:

Part thickness	Less than 0.125"	0.125-0.150"	Over 0.250"
Total cycle time	35-40 sec.	40-60 sec.	60 sec.
Injection dwell	25 sec.	25-30 sec.	35 sec.

A rule of thumb for starting cycles: injection time should be set at 65% of total cycle; injection pressure should be set at ¾ maximum; mold temperature should be turned on in sufficient time to allow entire mold surface to come up to heat; and minimum molding conditions should be as follows—

	Grade 5	Grade 6	Grade 8
Rear cylinder zone	410° F.	440° F.	480° F.
Center cylinder zone	380	400	440
Front cylinder zone	360	400	440
Nozzle temperature	325	350	375
Mold surface temperature	125	140	175

The temperature profile is from low to high, front to rear zones. As the cavities fill and the heat requirement is indicated, it is preferred that rear zone temperature be increased before additional injection pressure is applied and before front and center zones are increased.

Annealing molded parts

Annealing a properly molded part both improves its quality and ensures durability in service. To test its practical significance with Plexiglas, an outdoor exposure program was begun over five years ago. Automotive parts molded commercially under known conditions were annealed and tested at Bristol, Pa., together with unannealed samples of the same parts. These included tail light lenses, parking light lenses, speedometer panels, clock dials and faces, fuel gage dials, and reflectors. All were examined periodically over the five year period.

Observations showed that in commercially molded parts, the use of high cylinder temperatures and high mold temperatures produces better molded parts which are more resistant to crazing and the opening of weld lines on outdoor exposure. Annealing improves craze resistance and helps prevent the opening of weld lines. It has less effect, however, on improving the performance of Plexiglas VS parts than it has on Plexiglas V or VM.

It seems definite that, if maximum resistance to outdoor exposure is necessary, annealing is well worth the time and money. A further implication—Plexiglas VS should be limited to applications involving a minimum of outdoor exposure.

A test was devised to check the stress in molded acrylic parts, both as molded and as annealed. It involves dipping the parts in ethyl acetate and observing them when removed. The actual technique is as follows: Parts and solvent are maintained at 25° C., or at room temperature, and the parts are immersed in the solvent for two minutes (Grade 8) or fifteen seconds (Grade 6 or 5); the molding is air dried for 3-5 minutes; and examined for crazing and cracking.

The moldings should be relatively low in moisture content, and the ethyl acetate should be 98% pure and free of foreign matter. It is important that the alloted immersion time is not exceeded as this will damage the surface of the molded part severely. The tested parts must be discarded after examination.

The aforementioned test has been used with an assortment of molded parts collected from molders. Results indicate that although well-molded parts will not craze when dipped in the ethyl acetate bath, poorly molded parts will craze readily. A properly annealed part will not craze when solvent-dipped. It should, however, be cooled to room temperature before being immersed, otherwise it will craze severely and possibly rupture.

There is, at present, no information available to correlate the results of this test with part service life. Such information would be extremely valuable, but could be obtained only by following the history of a sufficiently large number of moldings. We believe that the test can establish whether one molded part is better molded than another, however, without additional experience the test cannot label a given part as satisfactory or unsatisfactory.

In the various molds which we have converted from conventional gating to either tab or restricted runner gating we have had the advantage of testing parts for craze resistance by the ethyl acetate test. Conventionally gated parts craze, generally along the line of flow, in the standard immersion time. Tab gated parts did not craze in the standard time and some parts did not craze even after immersion for 6 minutes. Some slight checking occurred at the sawed edge where the tab was removed. The usual surface-destroying action of ethyl acetate was not observed in the tab-gated parts even at 6 minutes.

Summary

Acrylic materials can be molded over a wide range of conditions and gating design. It is certainly the intention of the mold builder, molder, and the material supplier to provide the end user with a product with excellent physical properties and appearance. It is important to us, the material supplier, to investigate the processes under which you, the molder, are using. We can then make continued improvements. It should be pointed out here that we never could have developed the systems discussed without the complete cooperation of our customers. Their intense curiosity as to why materials behave as they do, plus their willingness to "cut and try" to prove the point (in spite of many disappointments), is much appreciated.

—The End

Compression & transfer molding

Selling with the times

Edited by: PAUL E. FINA*

In most of the previous articles, this section has concerned itself primarily with many facets of technical and engineering problems in the thermosetting field. The concepts reviewed were not necessarily new thinking but were intended to keep the molder informed of the latest developments and innovations. Such items as tolerances, molding pressure requirements, shrinkage control, quality molding, epoxy molding compounds, data sheets, technical conferences, etc., were discussed.

It is important, too, to discuss the organizational changes that have been occurring in the past few years. The thermosetting field has not remained at a status quo with conservatism the governing factor. Behind the growing markets has been a liberal viewpoint. The custom molder who has confined his interests to a limited sphere has been hurt considerably. He has allowed the more open minded forms to surpass him. The new viewpoint has resulted in many changes in management thinking.

The primary evolutions in the thermosetting field may be listed as follows:

1.—The emergence of the captive molder into a volume purchaser of raw materials (with its consequential effect on the custom molders).

2.—A host of new plastic compounds.

3.—The trend towards automation (so as to lower labor costs).

4.—Potential competition with foreign commerce.

5.—Advanced molding technology and fabrication techniques.

6.—Improvement in the properties of existing materials.

The impact of these developments has persuaded many molders and fabricators to reassess their aims and adapt themselves accordingly. Several companies have decided to specialize in a particular phase of the plastics field. A few material producers have decided to become more basic in their product, leaving the final compounding to the smaller, more specialized suppliers. Some compounders of molding materials have decided to mold their own materials, while many molding establishments have sold their molding operations. The effect has been dynamic! Management has been forced to reorganize with major shifts in personnel.

One of the major areas subject to reorientation has been the sales force. Each company, especially the custom molder, has had to study its most effective means of selling. The success of any company depends on a good sales program with the salesmen carrying out the sales policies. Since they are usually the only contact between the customer and seller, they must be carefully chosen and trained.

The nature of selling

What kind of person is needed to carry out the tremendous responsibility of selling? Who should be a salesman? The salesman must have a technical background; he must be pragmatic; he must be sophisticated (informed); and he must be logical. The widened scope of plastics indicates that a more qualified person than ever is needed to call on the prospect. The standard "representative" type of selling has become less and less effective.

The sophisticated salesman or sales engineer (whichever he may be) knows that emotional selling is passé. The sales close arguments for obtaining the order should be confined to logical reasoning. The demonstrations prior to close must include both information and facts. The initial approach must have been pragmatic. By pragmatism we mean that a "cash value" is associated with the prospective call. Each call should be practical and of value to both salesman and customer.

The salesman should assess the application in question and then decide whether the requirements can be met by his company. Should he decide that his company has the equipment, tools, correct materials, experience, and know-how needed to produce the part, then he should continue with his efforts. It is not expedient to sell what is not practical to produce.

* Director of Sales Engineering, Fiberite Corporation

Selling can be fun

When the salesman or sales engineer calls on a potential customer, he should stress his company's ability to produce, indicating the services afforded. He should instill confidence. Other features to stress are quality control, good tooling design, reliability of equipment or presses, and design experience. Selling on a basis of price is risky and usually implies reduction in quality or taking a financial loss. This is not the day of price cutting but the day of quality selling!

Selling can be an interesting experience. Selling should be logical, not emotional, and the presentation should be plainly given. A buyer or engineer can only be impressed when he hears rational and reasonable arguments simply told. Cries for business, pleading for business, wanting a "chance" at a job, taking on a pathetic appearance, or taking issue with his customer's negative attitude, are poor means to an end.

Selling can be fun when the salesman (or sales engineer) is confident of his company's resources and his own ability. It is a far better achievement to have sold on the basis of quality than to sell on a basis of price. There is a thrill to a "close" with the knowledge that your company can make a profit which is in direct contrast to the fear a supplier has when he has made a calculated risk on the selling price. Fair, original prices which are consistently cut could lead to eventual demise of a company.

The nature of decisions

Since a salesman is constantly confronted with decisions, let us examine what constitutes a decision. It can be argued that decisions are based on accumulated experience and knowledge, whereas judgments are based on wisdom. Good decisions and right judgments are essential for the proper development of any company's program. But let us delegate judgments to management and confine this discussion to the nature of decision making. Major decisions in a company can be made by a qualified person or by a group of individuals, each qualified within a specialized segment of an organization.

Seldom can one person lay claim to knowing everything about tooling, production techniques, estimating, purchasing, and engineering. The salesman or sales engineer calling on an account must find out who makes the decisions, planning his call so as to include the proper man or men at his prospective customer. His presentation varies according to the interest of the man listening.

The purchasing agent is interested in prices, delivery, quality, and quantities. The engineering department is interested in design, data, properties, behavior of the materials, and any technical information. The estimator is concerned with weights, costs of materials, suggested cycles, and finishing problems. Inspection must know the amount of quality control to be exercised. These people and others may play quite a role in the final decision leading to an order. Thus, it behooves the sales engineer (or salesman) to determine quickly the organizational responsibilities within the company he is calling on in order to be effective. The salesman who develops an acumen for sizing up a situation quickly is an asset to his company.

Survival of the fittest

Today, there are many different kinds of molders—the large custom molders, the small molder who has a press or two with the owner running the equipment himself, the proprietary molder who specializes in a certain type of product, the captive shop which has a department for plastics and prefers to do its own molding, the molder who is strictly high production and automation minded, and the shop which prefers to mold a limited type of materials.

The bigger companies shouldn't begrudge business to the smaller houses. Nor should they resign themselves to the fact that the captive shop is going to prevent them from doing business as usual. The large custom molders should utilize their well developed talents to go after specialty items. Instead of competing to the point of no profit, the large custom molder should shift his skill to the more difficult projects and create new applications. Specialized skills demand a fair price, and deservedly so. The molders with a research department, the molders who have chemists, the molders with the high grade engineers—all have distinct advantages which should be put to use.

The small shops should have the normal run of jobs since they can easily quote lower prices. These lower prices encourage the end user to use more plastics. The better staffed and better equipped molder can then benefit.

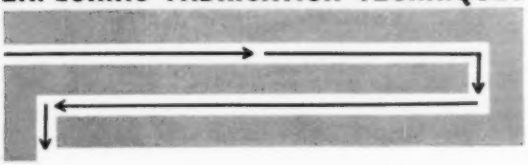
The large molder should look into the new plastic materials being brought out. These materials would go unnoticed but for the tremendous promotion job done by the material manufacturer. Molders who complain that the producers of raw material are determining the applications and influencing end users, should be grateful instead. It is doing their work and increasing their business.

In conclusion, let us say that there is enough work for all. It is a matter of going out after it. One must adapt to the changing scene. Let the small molder gain the job requiring general ability. Let the captive molder mold his own products when it is economical for him to do so. Let the proprietary molder develop the specialized skill in one line. Let the larger molder (better equipped, better staffed) develop the intricate, the new and specialized applications wherein his price will not be questioned. Let the salesman or sales engineer employed by each of these types of molders adapt his sales techniques to fit the ever changing times.

—THE END

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES



By L. J. ZUKOR, *ENGINEERING EDITOR*

Biaxially Oriented Polystyrene

Biaxial orientation has created quite a stir among film and sheet extruders—an interest so keen that many film producers and film converters are looking for ways and means to extrude and orient their own stock. The main impetus for these investigations is the low profit picture existing between the price of resin and the price of finished goods. The dropping price of styrene, for instance, has caused some converters to investigate the possibility of extruding and/or orienting film for their own use.

As I stated in the November column, biaxial orientation of film and sheet has been with us for several years, primarily as a captive operation. However, I am convinced that no amount of captivity can successfully keep a process secret. What one man devises, another can duplicate in time. The only thing that can possibly be gained by holding a process captive is that it will provide a manufacturer with some earned "lead-time."

In the plastics industry, it has been usual for a new idea or patent to be offered to the industry on a royalty basis or by license agreement. While this is also happening with the orientation process, it has been proceeding at a snail's pace. I recently asked a manufacturer his views on licensing and this was his answer: "We have given extensive thought to licensing and have come to the conclusion that we do not choose to license our process. We could not hope to regain our large research investment by any royalty or license arrangement. Only by direct manufacturing can we realize a proper return on our original investment."

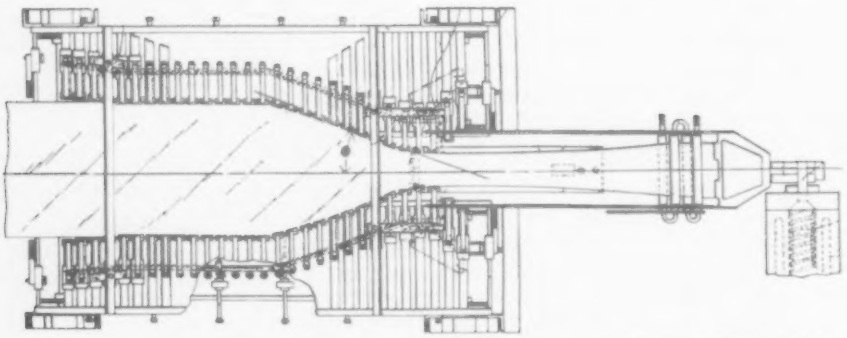
What he said is certainly true, but does not change the situation as it exists today. Some machinery builders are offering stentering machines, modified for plastic webs. Some also offer assistance and know-how in the handling of non-proprietary resins.

Those wishing to orient film or sheeting should first investigate the patent situation thoroughly. Biaxial orientation is held to be proprietary when patent claims describe a process for making and orienting film or sheet from a particular resin. Where process patents are concerned, the only alternative is to seek license from the patent owner. If a resin is a nonproprietary one, and a machine patent is involved, then it can be assumed that if any other type of machine is substituted, the method used will not conflict with the claims of the patent.

General-purpose polystyrene has been captively oriented for the last three years. Rubber modified-high impact styrenes, styrene-acrylonitrile, and ABS copolymers have also been oriented. Biaxial orientation does not affect the most desirable characteristics of polystyrene (clarity, rigidity, and non-toxicity), but does increase its tensile and impact strength.

Among the very large producers of biaxially oriented film and sheet in this country are Dobeckmun (Dow), Du Pont and Plax. In Europe, they are Gevaert and North German Sea Cable Works; both hold U.S. patents for proprietary designs of specialized stentering machines.

There are four methods of orienting styrene sheet and film. Two methods are described in this article, while the other two will be covered at a later date. The first method, developed by Plax, starts with extrusion of general purpose polystyrene at 400° F. ±15°. Actual temperature of the melt depends on such other process variables as screw speed, pressure at the sheeting die lips, and draw-down speed. In orienting, ex-



diagrams courtesy: Plax Corp.

Proprietary biaxial stretching machine.

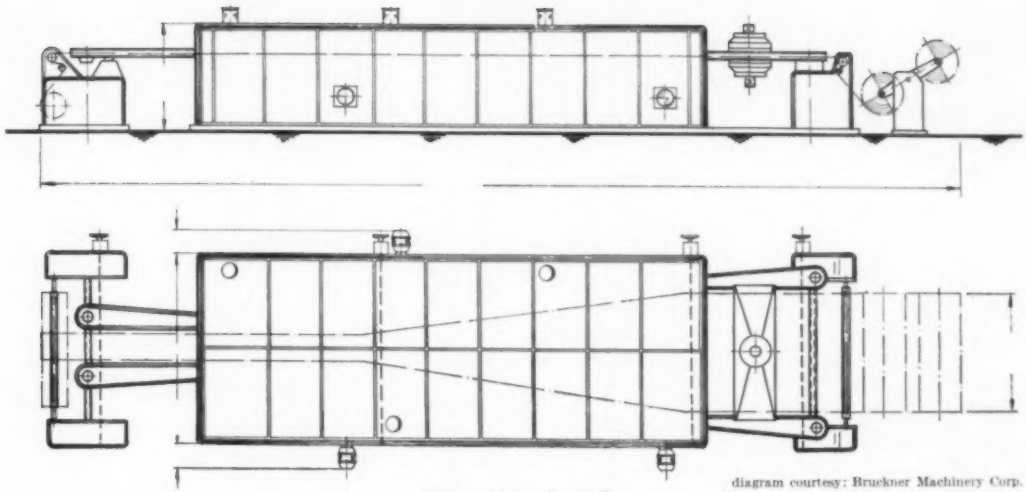


diagram courtesy: Bruckner Machinery Corp.

Stenter-frame diagram.

trusion speed is lowered but a relatively high die pressure is maintained. The lowest allowable melt temperature should be used, to obtain a medium- to high-gloss finish. The web first contacts a chill roll which sets its thickness. It then travels over other heated rolls (about 200° F.) which brings the surface temperature of the web up and its core temperature down to a point slightly above the transition temperature of the resin. The temperature given by Bailey* for stretching runs 205-250° F. This has been corroborated in recent tests (220°-260° F.) run for Bruckner Machinery Corp., Cedar Grove, N.J.

By controlling a predetermined speed differential between the stenter unit or T. D. (transverse direction) stretcher and the extruder take-off rolls, orientation takes place in the machine direction. Draw-down or stretch ratio is about 3:1. Stenter unit width must be adjusted to receive a narrower web than is extruded. A definite width loss occurs due to the high longitudinal stretch. Tensile strength increases two-fold in the direction of stretch and reduces noticeably at right angles to this direction. When the plastic web is cooled and measured, its tensile reduction ratio of length-to-width can be as much as 4:1.

Clamps on both sides of the stenter frame grip the edges of the web as it enters. This becomes the selvage which is later trimmed away. Clamp chains, guided along channel-cams, form an angle with the center line of the web and machine which determines the rate (speed) of transverse pull. This angle is adjustable in the machine, since the rate must be slower than in the machine direction. A longer stenter unit will allow a shallower angle which causes a slower rate of pull than will a shorter frame. Temperature at the beginning of transverse pull is about the same as that used for the pull in the machine direction. This is given by Bailey as 255° F., and is also in close agreement with recent test results.

The stenter-frame is enclosed by an insulated oven chamber divided into fixed temperature zones. Temperatures in the ovens increase slightly from the point of entry (240° F.) to the mid-section of the stenter-frame (225° F.), then reduce gradually to 170° at delivery.

The second method uses standard extrusion take-off equipment. Machine direction orientation is obtained by increasing draw-roll speed relative to cooling roll speed. The cooling roll, in this instance, should be maintained at about 200° F., the gel point of polystyrene. Avoid air drafts during stretching, as cool points in the web will tear rather than stretch. Stock, oriented in the machine direction, is fed into the stenter frame and stretched transversely so that both

(*Continued on page 75*)

photo courtesy: Plax Corp.

Polyflex film being produced at Plax Corp.

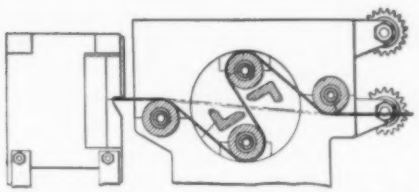
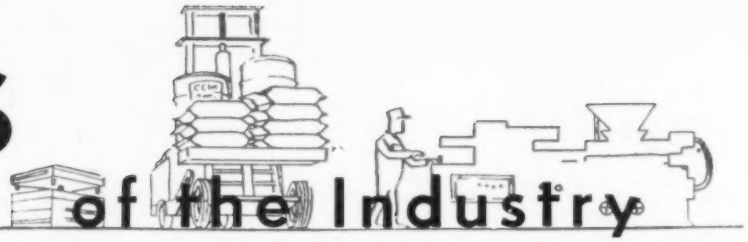


diagram courtesy: Plax Corp.

Machine element for longitudinal orientation.

* Bailey, James, "Stretch orientation of polystyrene and its interesting results," India Rubber World (Plastics Technology), vol. 118 no. 2, (May 1948).

NEWS of the Industry



general/specific interest

Seal-Draft Weatherstrip Division, Sun Screen Products, Inc., Spokane, Wash., offers a 20-year guarantee on the flexible Geon vinyl sealer strip used in its doorway weatherstrip.

business developments

Allied Chemical Corp. announced that facilities will be installed for the production of melamine crystal by its nitrogen division.

Tetrafluor, Inc., has purchased additional equipment and broadened its product lines. The firm is located in Englewood, Calif.

Heisler Corp., Wilmington, Del., has established a development and testing laboratory as the first step in expanding its line of thermoplastic powdered resins. The firm's prime interest, however, is in custom compounding.

Automatic Plastic Molding Co., Berkeley, Calif. has installed a special automatic injection press for turning out 32,000 sealers per hour for the automotive industry.

new plastic companies

Woodbridge Plastics, Inc., has been formed with headquarters in Woodbridge, N. J., to provide custom compounding of vinyl and polyethylene for the wire & cable, vinyl shoe, profile extrusion, and injection molding industries.

Elotec Corp. is a new plastics firm located in El Monte, Calif., which will produce electronic components and air filters.

market forecasts

Filon Plastics Corp. reports that the reinforced plastic panel industry reached the 100-million square foot mark in 1960, and may reach 150-million this year.

Polycast Corp., Stamford, Conn., predicts a substantial increase in the use of acrylic and other types of cast plastic sheet to a total of $60-million for this year.

agents, distributors & agreements

Commercial Resins Corp., St. Paul, Minn., has named the following distributors for its CoRezyn materials: Robert Stough Plastics Co., Cleveland; Sepsco Plastics, Inc., Atlanta; Sisko Plastic Enterprises, Miami, Fla.; and Lawrence & Erausquin, Toledo, O.

Johns-Manville has cancelled its agreement with Dumont Mfg. Co., whereby the latter firm would have fabricated J-M's Min-K aviation insulation.

Seiberling Rubber Co. has named Nagel & Nax, Inc., St. Louis, Mo., distributor for its line of Seilon plastics.

Minnesota Mining & Mfg. Co. and Warner-Lambert Pharmaceutical Co. have suspended action aimed at combining the two companies, awaiting clearance by the Justice Department.

change in corporate name

Philip Shuman & Sons are now conducting business as Philip Shuman & Sons, Inc. The firm is located in Buffalo, N. Y.

changes in ownership

Barash Co., Inc., vinyl coated fabric manufacturer, has been acquired from U. S. Plywood Corp., by Samuel Abrams, Ira Abrams, Harold Holden, and Michael Barash.

Interchemical Corp. has announced the purchase of Landers Corp., Toledo, O., a manufacturer of laminated and plastic coated fabrics. The Landers plant will operate as a unit of the newly-formed coated fabrics division.

new plants, labs & additions

Ferro Corp. recently completed a quarter-million dollar plant in North Miami, Fla., for the production of fiber glass reinforcements and colorants. J. Gerry Browne will manage the operation.

Dow Chemical Co.'s Louisiana Division officially opened its polyethylene plant in Plaquemine, La.

Columbia Technical Corp. has opened its new plant in Woodside, N. Y. Among other protective coatings, the firm manufactures fire retardants.

Witco Chemical Co. has completed a $250,000 expansion of its Chicago Laboratories.

U.S. Rubber's Naugatuck Chemical Division has moved its New York and Philadelphia district sales offices to 97 Bayard St., New Brunswick, N. J.

Girdler Process Equipment Division, Chemetron Corp., has moved its headquarters, sales, and engineering offices to 2820 W. Broadway, Louisville, Ky.

New Materials

For more information check Readers' Service Card (p. 83)

PE Pipe Formulations

Among the materials suppliers developing polyethylene pipe resins are Eastman Chemical Products Inc., Union Carbide Plastics Co., and Phillips Chemical Co. All three have made available resins which have been approved by the National Sanitation Foundation for the production of pipe suitable for transmission of potable water.

Eastman has two Tenite polyethylene materials reported to yield pipe with smooth, glossy surfaces at fast production rates. The type II formulation, 2521E-60099, has a density of 0.939; the type III formulation, 2811E-80010, a density of 0.950. Properties of the resins, type II and III respectively, are: melt index—0.9-1.4, 0.6-0.8; tensile at upper yield, psi.—2480, 3350; and stiffness in flexure, psi.—68,000, 97,000.

Readers' Service Item 1

UNION Carbide's DGDA-2033 Black 4865 is claimed to offer advantages in long term stress properties and processability at high extrusion rates. It is designed to meet the requirements for type II, series 2 and 3. Melt index is 0.03; specific gravity 0.955. Other properties:

Tensile strength, psi	3400
Yield strength, psi	2800
Elongation, %	250
Stiffness at 25° C., psi	400 000
Stress cracking resistance, Fo, hrs. @ 50° C. in Igepal CA	>500
Shear strength, psi	3000
Brittleness temp., F_{20}, °C	−100

Readers' Service Item 2

MARLEX TR-212 high density resin is especially suitable for coilable pipe for cold water service. According to Phillips, one-inch pipe made from this resin sustains a hoop stress of 1800 psi. at 1000 hours and 80° F.

Readers' Service Item 3

Irradiated Polyolefins

MIMX Corp. has developed a line of composite polyolefin compounds bombarded with gamma radiation. The MIMX 600 compounds are characterized by their tendency to resume original configurations after being temporarily locked into other shapes. Physical characteristics, including resistance to high temperature, acids, solvents, and alkalies, are not affected by changes in shape.

The compounds are irradiated after they have been formed or molded in the desired shape, after which they can be heated, reshaped, and locked in any convenient shape. When proper heat (about 300° F.) is reapplied, the parts return within 1% accuracy to their original forms and dimensions.

The compounds may be used to encapsulate or cover such irregularly shaped items as valves, capacitors, and switches. Now available in conductive and nonconductive forms the compounds can be further modified to enhance thermal conductivity, ablation, and other characteristics.

Readers' Service Item 4

Epoxy Resin Products

Epoxy resins for a multitude of purposes and with greatly differing characteristics have recently appeared on the market. Among them are:

Melpak E-200, a product of Melpar, Inc. A room-temperature curing resin, it is reported to satisfy requirements for most general purpose potting, encapsulating, and casting applications. Melpak E-200 is noted for low shrinkage, machineability, adhesion to most other materials, and self extinguishability. Typical properties of the cured epoxy are:

Dielectric strength, volts/mil	430
Dielectric constant, at 60 cps	3.37
At 1 mc	3.24
Loss factor, at 60 cps	0.064
At 1 mc	0.051
Power factor, at 60 cps	0.019
At 1 mc	0.016
Linear shrinkage, %	0.1–0.2
Water absorption, 24 hrs., 77° F., %	0.006
Tensile strength, psi	8,000
Flexural strength, psi	16,000

Readers' Service Item 5

A LINE of five epoxies formulated by Allaco Products. Foundcast 101 is intended for making molds and patterns; Sandbind 201 for making molds for casting epoxy duplicates; Facecoat 301 for brushing on molds and patterns; Multicast 401 for casting jaws and chucks; and Layup 501 for binding fiberglass layups.

Readers' Service Item 6

A SERIES of resins in the form of a single-component, dry, non-toxic casting powder for use with metals, glass, and plastics. The powder is claimed by Epoxy Products to exhibit excellent moisture and chemical resistance, and high electrical characteristics, when cured. Variations in cured and uncured properties and processing requirements are available, as are premeasured pellets for high volume, automatic production. The different formulations may be used for encapsulation, impregnation, embedding, end sealing and bonding, ruggedizing, and potting.

Readers' Service Item 7

TWO resins produced by Isochem Resins Co. One-part, thixotropic Isochemgel 104 is self flexible for extreme thermal shock. This dip and adhesive has indefinite viscosity and thixotropy control at all temperatures. The second material, Isochemrez 450, is a peracetic epoxy of 600 cps. viscosity. It is noted for its electrical properties when catalyzed with Isochem's eutectic metaphenyline diamine hardener #16. Initial viscosity of the catalyzed resin is 200 cps.

Typical properties of cured Isochemrez 450 catalyzed with hardener #16 and Isochemgel 104 follow.

	104	450
Specific gravity	1.13	1.1
Volume resistivity, ohm-cm	3×10^{12}	$6 \times 10^{16} - 5 \times 10^{9}+$
Dielectric strength, volts/mil	390	510
Dielectric constant	4.4	3.46
Operating temperature range, °C	−75 to 165	−50 to 200

Readers' Service Item 8

DOW Chemical Co.'s X-2673.2, X-2673.6, and X-2674—epoxies designed to provide increased toughness and flexibility to conventional epoxy resins. These light colored, low viscosity fluids may be added to common liquid and solid epoxies and to Dow novolac 438. They are cured with all common hardeners.

According to the producer, these flexible epoxies can increase flexure strength 25-40%. Highly flexible systems may show elongation up to 300%.

Readers' Service Item 9

High-Impact ABS

U. S. Rubber Co.'s Kralastic MH can be fabricated by extrusion, injection molding, vacuum forming, and lends itself to such machining operations as drilling, tapping, sawing, turning, cementing, and routing. This easy-molding acrylonitrile-butadiene-styrene resin is claimed to possess superior rigidity, dimensional stability, high heat resistance, and excellent chemical and electrical properties which suit it for industrial and consumer applications. Its fluidity recommends it for sheet and profile extrusion, and produces streak-free, high gloss sheet.

Temperature-stress characteristics for ABS plastics are generally higher than those of highly crystalline plastics. MH

LOOKING FOR A CATALYST FOR THE POLYMERIZATION OF VINYL CHLORIDE?

TRY **ALPEROX C**®

SPECIFICATIONS.

Lauroyl Peroxide	95.0% (Min.)
Active Oxygen	3.76% (Min.)
Free Fatty Acids as Lauric Acid	1.5% (Max.)
Alkaline Soaps as Calcium Laurate	1.5% (Max.)

THERMAL DECOMPOSITION.

Material	Solvent	Temp. °C.	Half Life in Hours
ALPEROX C	Benzene	100	0.1
Benzoyl Peroxide	Benzene	100	0.33
ALPEROX C	Benzene	70	3
Benzoyl Peroxide	Benzene	70	12

ALPEROX C (Technical Lauroyl Peroxide) is the preferred catalyst for the suspension polymerization of vinyl chloride. Concentrations of 0.1 to 1.0% confer greater heat stability on the final product and facilitate higher conversion velocity. As a catalyst for curing polyester resins, it is especially applicable to the production of small, clear, transparent castings, setting at a temperature of 60° to 80°C. For cold setting with tertiary amines as accelerators, less discoloration occurs than when using benzoyl peroxide.

WRITE FOR DATA SHEET

LUCIDOL DIVISION

WALLACE & TIERNAN, INC.
1740 MILITARY ROAD
BUFFALO 5, NEW YORK

has recommended top continuous use temperature of 185° F. Other properties:

Specific gravity	1.04
Impact strength, ⅛-inch sample	
Izod notched, ft. lbs./in. notch	
73° F.	2-3
32° F.	2
—40° F.	1
Charpy unnotched, ft. lbs./in.	30-45
Flexural strength, psi	9500
Flexural modulus, psi	3.0×10^5
Tensile strength, psi	6500
Hardness, Rockwell R.	107
Deflection temperature, 264 psi, °F.	200
Flammability, in./min., ¼-in. sample	1.25
Ignition temperature, °F.	510

Readers' Service Item 10

Synthetic Pearl Pigments

Murano Colors, a synthetic pearl essence providing color along with pearly lustre, has been introduced by Mearl Corp. Available in formulations for surface coating and for incorporating into plastics, the colors provide multiple color effects.

Murano Colors have twin inherent colors, one observed by reflected light and the other by transmitted light. For example, a polyester cast sheet containing red pigment appears red when held against a dark background and examined by reflected light, and green when viewed by transmitted light.

Colors such as gold, red, blue, green, and orange are available. They are produced by optical effect rather than by absorption. Multi-color effects may be obtained by using several colors in combination. The colors are of moderate intensity.

Readers' Service Item 11

Chopped Strand Fiberglass Mat

Garanmat, a fiberglass chopped strand mat available from Johns-Manville, is claimed to wet out 3-5 times faster than competitive products, be more uniform in fiber distribution and weight, and have a white color that will not affect the color of finished laminates.

The random pattern mat is made of continuous filament roving, chopped into lengths of approximately two inches, to which Garan binder has been applied. Suitable for use in reinforced plastic boats and translucent structural panels, the mat is noted for easy draping.

Garanmat is now available in weights of 1¼, 1½, 2, and 3 ounces per square foot, in widths up to 76 inches.

Readers' Service Item 12

Names in the News

John W. Pool, Jr.

John W. Pool, Jr., sales manager of the plastics division of Koppers Co., Inc., has been appointed a vice president in that division.

George Dietz, Jr., has been moved up to the position of manager-product engineering by Norton Laboratories. He was previously a process engineer.

Charles S. Langdon has been appointed director of sales by Crystal Essence Corp. He was formerly national sales manager for a division of Chipman Chemical Co.

Islyn Thomas

Islyn Thomas has resigned as president of Newark Die Co. to act as international consultant to the plastics industry. A founder, charter member, and past president of the Newark Section of SPE, he also served for six years on the National Council and in 1951 as national president of the society. He has been active on the Board of Directors and in the Mold Makers' Division of SPI. Mr. Thomas has written a book on injection molding, and is presently writing a series of technical articles on blow molding for PLASTICS TECHNOLOGY.

Philip J. Weaver has been named manager of administrative services for B. F. Goodrich Chemical Co.'s Avon Lake, O., development center. He has been succeeded as manager of the product application laboratory by **Norman G. Duke.**

Henry Weckbacher is the new manager of the New Ulm, Minn., plastic products plant of B. F. Goodrich Industrial Products Co. With Goodrich since 1947, he had been personnel manager of the Salem, Ind., plant.

Durbin Hunter has been elected vice president and general manager and a director of Plastics Corp. of America. Previously, he was associated with Seamco Chemical Co.

Osgood V. Tracy, former president of Esso Standard, division of Humble Oil & Refining Co., has been elected a director and executive vice president of W. R. Grace & Co. He will fill the post held by the late **Marlin G. Geiger.** Mr. Tracy will be in charge of the chemical business of Grace.

William Lawrence

William Lawrence has been designated supervisor of the technical service laboratory, pigments division, CIBA Co., Inc. Serving in a technical capacity in the paint industry for 25 years, Mr. Lawrence was with Flood and Conklin Mfg. Co. prior to joining CIBA.

W. C. Leipold and **Maurice Brown,** former president and secretary-treasurer of Plastics Horizons, Inc., have severed connections with the company upon completion of successful changeover to Celanese Corp., which purchased Plastic Horizons last May. Messrs. Leipold and Brown have established Airpak, Inc., which will manufacture a plastic packaging product. In this organization, they are associated with **M. Chavannes,** inventor of the product.

R. Emerson Lynn, Jr

R. Emerson Lynn, Jr., new manager of program planning for B. F. Goodrich Chemical Co., is responsible for integrating plans for product development and for developing project evaluation techniques. With Goodrich since 1952, Dr. Lynn had been manager of the chemical engineering department at the research center.

William I. Hollar

William I. Hollar, general manager of Jomac-North, Inc., has been elected vice president. Before joining the company as general manager in 1953, he was engineer and production supervisor of the Fabricast division, General Motors Corp.

H. D. Howard, B. W. Fishel, and **G. A. Fox** have been named, respectively, vice president, sales manager, and controller at Ray Products, Inc. Mr. Howard has been with Ray Products for six years, most recently serving as plant superintendent. Mr. Fishel has had experience with Lockheed Aircraft Co. and Swedlow Plastics Co. Mr. Fox was most recently an accountant with Aerojet-General Corp.

Carl A. Gerstacker has been named successor to **Earl W. Bennet,** who recently resigned as chairman of the Board of Directors of Dow Chemical Co. Dr. Gerstacker will retain his position as chairman of the finance committee. Dr. Bennet will continue to function on the Board and finance committee.

In another major change, **Herbert D. Doan,** manager of the chemical department, has been named executive vice president. He succeeds **Dr. Mark E. Putnam,** who died November 6.

Frederic A. Henneke, recently made controller-secretary at Lunn Laminates, Inc., was also elected to the Board of Directors. Before joining Lunn he was assistant treasurer of Dayton T. Brown, Inc.

OBITUARY

Hylton Swan, retired vice president of Bakelite Corp., now Union Carbide Plastics Co., died on December 15 after a long illness. He was 86 years old. He had been associated with Bakelite from 1911 until his retirement in 1940.

Mr. Swan was born in Barrow-in-Furness, England, and came to the United States with his family when he was 10. One of the early pioneers in the phenolic plastics business, he made a number of contributions towards methods of economical plastics fabrication and also developed uses of the material in the automotive industry.

New Equipment

For more information check Readers' Service Card (p. 83)

Machine for Two-Part Compounds

Duo-Flo pumps and guns for continuous pumping, metering, and application of flowable two-part compounds have been announced by Pyles Industries, Inc. The equipment may be used with compounds ranging in viscosity from 0-20,000 cps. It will meter two-part compounds in ratios of 5:100 to 50:50.

The machine is recommended for any epoxies, polyurethanes, polyesters, and foams. It is claimed that only a few minutes are needed for purging and cleaning.

Readers' Service Item 21

Air-Operated Injection Molder

The Mini-matic ¾-ounce injection molding machine manufactured by Newbury Industries, Inc., can be used for continuous production of specialized items in all thermoplastics.

Model 60AM80 features horizontal clamping with molds 6 by 5⅛ by 5 inches, four tie rod construction, and normal cycle time of 2-4 per minute. Dry cycle time is 480 per hour. Cycles are controlled by a self-contained eight-element timer. All phases of the cycle are adjustable from 0-15 seconds. Available rams are ⅝ and ¾ inch. Maximum operating air pressure is 150 pounds.

For safety, the mold automatically opens if a part is not ejected at the end of a cycle.

Readers' Service Item 22

Variable Frequency Power Pack

Model 31A Intratherm VF Power-Pak, designed specifically for fusion of plastics, is available from Gregory Blessing Associates. The 500-watt unit incorporates a pulse integrator which, in combination with a variable frequency feature, is reported to permit faster cycling without electrode flashover and imperfect welds.

The number of parts has been minimized for long service life. Solid state rectifiers and convection cooling are provided. If Intratherm is correctly installed, there should be no radiation problems. The mat-finish aluminum measures 10¼ by 17 by 7¼ inches. Input is 115 volts, 50-60 cycles.

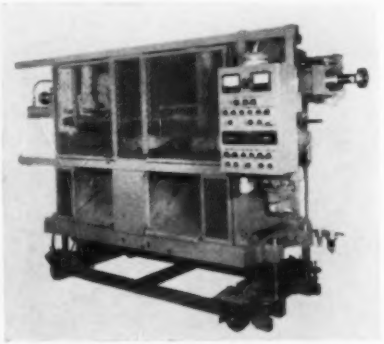
Readers' Service Item 23

Blow Molding Machinery

Waldron-Hartig Division, Midland-Ross Corp., and Peuchen Engineering Corp. have introduced machinery for blow molding. Waldron-Hartig, which has been making custom machinery, now has a standard blow molder available. The unit, which operates on the ram accumulator principle, has a track-mounted press with vertical jacking adjustment to clear dies for easy mold changing.

Two dies permit double mold operation with shots weighing from 1 to 4¾ pounds. The X-alloy-lined accumulator has a hardened, polished, water cooled ram. A safety switch cuts out drive if the accumulator is overloading.

The press, with platens 24 inches square, exerts clamping pressure of 10 tons. Distance between platens with simultaneous closing runs from 6 to 26 inches; with non-simultaneous closing from 6 to 34 inches. There are four three-inch tie bars. A cooling water manifold with 12 connections is provided.



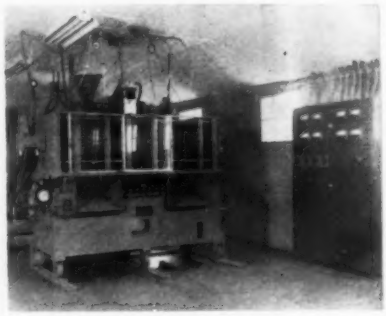
Waldron-Hartig Model 2424D-10 blow molding machine with manual, semi-automatic, or automatic operation.

Readers' Service Item 24

AMONG advantages claimed for the hydraulic Atlas blow molding machine, marketed by Peuchen Engineering Corp., is smooth, cushioned mold closing to speed production, maintain accuracy, and minimize downtime. This is achieved by means of a two-stage hydraulic system involving preliminary low-pressure pump closing followed by high pressure pump clamping.

Since each platen may be adjusted up to four inches, the necessity for shimming and construction of special mounting plates for molds is eliminated. Built-in air and water manifolds are equipped with eight valves. The unit is mounted on wheels that ride on metal floor tracks to ease cleaning and maintenance. Operation may be manual, semi-automatic, or automatic.

Following are specifications for the two models now available.



Atlas blow molder available from Peuchen.

	JR100	SR100
Platen area, w x h, inches	18 x 24	32 x 24
Molding area, inches	13 x 12	26 x 24
Maximum stroke, inches	4¼	5¼
Maximum distance between platens, in.	20	30
Maximum diameter of product, inches	8½	12½
Maximum length of product, inches	36	36
Number of molds	2-4	2-8
Clamp pressure, tons	6	24
Tie bars	2	4
Maximum dry cycles/hr	3,600	2,800
Height, C/L extruder, inches	60	76
Height, top of press, inches	56	66½
Height, top of head, inches	19	23

Readers' Service Item 25

Thermoset Resin Dispensers

Three available models of the Triplematic pump, series 600, will handle a wide range of resins and curing agents. Type II will proportion, mix, and dispense shots of two component resins; Type III delivers measured shots of three component resins; Type IV delivers a continuous flow of two component resins up to 40 pounds per minute. Within corresponding types, variations are available in volume per shot, rate of shot, ratio range, and volume mixing chambers. Machine height is 79 inches; depth, 53 inches; width, 53 inches. Nozzle height is 56 inches.

Readers' Service Item 26

DELSEN Corp.'s Model 395 variable ratio resin dispenser can, by means of a lever adjustment, dispense resin and hardener in ratios from 20:1 to 1:1. This flexibility allows adjustment to compensate for ambient temperatures. Provision is made for locking to prevent unintentional changes in the resin: hardener ratio.

Readers' Service Item 27

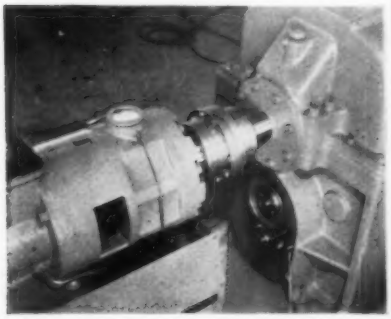
Improved Extruders

Two New Jersey companies are making news with extruders.

Prodex Corp., Fords, has improved the torque on its extruders through developments in gear transmission and screw shank design. Gear transmissions on these high torque machines are equipped with change gears to permit selection of the optimum reduction ratio and screw speed at any time. Since the new transmissions will deliver as much torque as the screw can safely handle, maximum output can be obtained from any given drive.

Along with the new gear transmissions, the extruders also feature a redesigned screw shank, reported to provide an average strength increase of 80%. The root diameter has been increased, and the low carbon steel has been replaced by a high alloy steel. The change improves fatigue resistance.

A seal at the screw shank avoids leakage of powders and permits the use of vacuum hoppers. Each of the three sizes—2½, 3½, and 4½ inches—is available with four standard interchangeable gear ratios.



Change gears of Prodex HT extruder.

Readers' Service Item 28

FOUR air-cooled extruders for large volume use are now in production at Modern Plastic Machinery Corp., Clifton. Four screw diameters can be supplied; the six- and eight-inch are standard, the ten- and 12-inch can be ordered. All sizes can be supplied vented or non-vented, and with L/D ratios of 20:1 and 24:1.

Floor space 5 by 18 feet is required for the six-inch model; 6 by 22 feet for the eight-inch model.

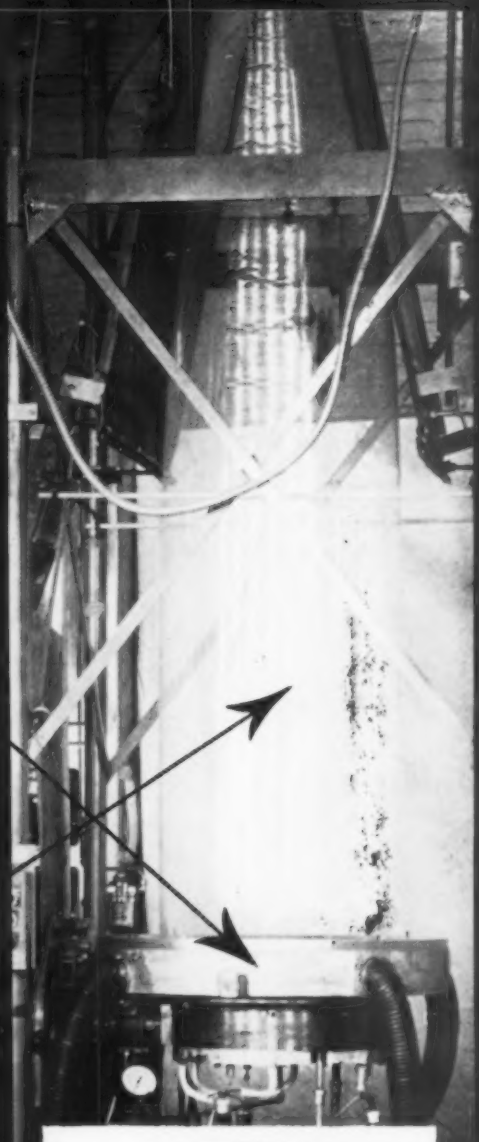
Readers' Service Item 29

Compressed Air Blow Gun

The Saf-T-Air Blow Gun manufactured by E. V. Nielsen, Inc., has been designed to eliminate flyback of chips, dust, or cuttings during cleaning of machines and work tables. Refuse will not rise more than one inch above the work surface when the gun is properly used, according to the company. The multi-orifice gun is claimed to clean efficiently at a single pass thus reducing air consumption.

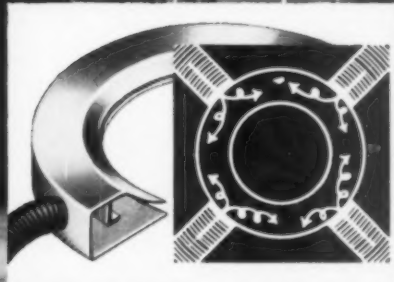
Blown Film

COOLING CAPACITY



1. D-S *Air Ring performance here . . .*

2. *provides faster "bubble" cooling for higher production speeds . . .*



Exclusive D-S **Velocity Control Air Ring** design prevents lopsided air distribution. Internal baffles provide "engineered turbulence" to evenly distribute air flow around entire circumference of die.

PRECISION EXTRUSION CONTROL IS OUR BUSINESS

Get Complete Details by Return Mail!

D-S DAVIS-STANDARD thermatic

26 WATER STREET, MYSTIC, CONNECTICUT

Name _____

Title _____

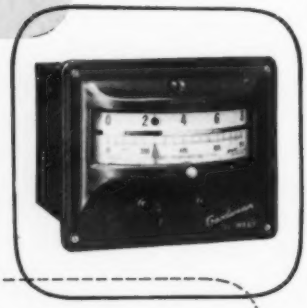
Company _____

Street _____ *State* _____

for **PLASTICS** . . . specify the **PROVEN** temperature instrumentation–by **WEST**

- Complete selection of Controllers to suit Individual Requirements in Extrusion, Injection Molding, Blow Molding, Vacuum Forming and Heat Sealing.
- Compact, solid state, free from *vacuum* tube-problems, minimum supervision or maintenance. Specify on Original Equipment or purchase directly.

Gardsman by WEST



MODEL JP series provides *proportioning* heater control.

MODEL JPT-2 integrates control of *both* heating *and* cooling for frictional heat in extrusion.

MODEL JSB series provides *stepless* heater control within *extremely close* tolerance; especially appropriate for extrusion die or injection nozzle control.

THERMOCOUPLES—complete selection of standard Thermocouples—including melt, bayonet, compression types preferred in working plastics—or send us your specifications on specials.

Ask your West representative (see Yellow Pages) or write direct for Bulletins JP, JT, JSB and Thermocouple Data Book.

WEST *Instrument* CORPORATION
SALES OFFICES IN PRINCIPAL CITIES
4359C W. MONTROSE, CHICAGO 41, ILL.
British Subsidiary:
WEST INSTRUMENT LTD.,
52 Regent St., Brighton 1, Sussex
Represented in Canada by Davis Automatic Controls, Ltd.

the trend is to WEST

Saf-T-Air Blow Gun.

While it operates from 30-100 psi, the gun has been pressure tested to 200 psi.

Readers' Service Item 30

Metering and Mixing Unit

Mitchell Specialty division of Novo Industrial Corp. is producing a relatively inexpensive NoVo metering and mixing system for reactive resins.

Capable of both continuous flow and intermittent individual shots, the unit mixes and dispenses such reactive liquid systems as polyurethane foams, epoxy resins, and polyesters. Designated the 100 series system, it comes with double-acting, electrically driven piston type metering element, reservoirs, and solvent purge system.

Readers' Service Item 31

Also Worth Mentioning

☐ Temco and Thermolyne laboratory and industrial heating equipment is now being manufactured with what is claimed to be a significantly superior refractory material. The material is used in embedded heating element plates and element supports for furnaces, hot plates, and other products. It is reported to have good thermal conductivity, mechanical rigidity, and high electrical resistivity.

Readers' Service Item 32

☐ The Model G Pencil Probe thermocouple introduced by Nanmac Corp. reportedly features a response time of less than ten microseconds, a continuous service temperature of over 2,000° F., a sensing tip with unlimited life, and an operating pressure range to 3,000 psi.

Readers' Service Item 33

Monsanto

LUSTRAN®

Monsanto
Announces

LUSTRAN A NEW FAMILY OF MATERIALS

molding and extrusion materials that break through the price-performance barrier!

LUSTRAN A NEW FAMILY OF MOLDING AND EXTRUSION MATERIALS

Take an existing product made with a common material, redesign and produce it with Lustran, and you will create a new product made with fewer pieces, little or no finishing, less labor, and at far lower cost than previously thought possible. You will have a product with an amazing combination of light weight, unusual toughness and durability. And it will have the sales appeal to help you increase volume—profitably.

Take that development product that's on the drawing board or the one that hasn't quite gelled in your mind . . . Lustran is the material to make these ideas come alive and earn profits. Or perhaps Lustran is the material needed to spark that elusive new product idea.

What is Lustran? Lustran is a unique composition of styrene and other monomeric materials produced by using an entirely new concept of molecular arrangement. It employs an advanced polymerization technique to meet the higher requirements of more applications more efficiently than ever before. Whether your product requires components that run two hundred to the pound or ten pounds each, Lustran is the material for rugged performance and profit improvement.

What are its properties? Lustran is so versatile that it can be formulated to meet a broad range of physical, chemical and price requirements. Lustran has a unique combination of effective strength, rigidity, and other desirable properties to a significantly high degree. One Lustran formulation, for example, has 4 times the impact resistance of rubber modified styrene, 10 times that of general purpose styrene. Lustran has exceptional impact and tensile strength, a vast color range, rigidity, abrasion and chemical resistance as well as efficient, economical processability. Products made with Lustran have excellent surface appearance, hardness and gloss. You can drive nails or turn screws into Lustran. At zero degrees Fahrenheit, a ⅛ inch thick 24 inch square sheet withstands the shock of 25 foot pounds. Under an 800 pound load, an automotive armrest made of Lustran remains intact while the supporting metal screws fail.

What are the uses for Lustran? Lustran has been successfully injection molded into parts weighing as much as 3½ pounds and vacuum formed in deep drawn parts weighing up to 11 pounds. It will find great demand in products which require high impact strength, rigidity, and breakage resistance in addition to the traditional important advantages of plastics . . . built-in color, corrosion resistance, single-piece construction. Lustran promises new developments in design and cost savings for new products, components and housings for business machines, automobiles, refrigerators, air conditioners, fans, radios, television, vacuum cleaners and other appliances, housewares, shoes, packages, pipe fittings and toys. Wherever performance and cost are critical, Lustran will find application.

What are its processing characteristics? Plastics converters who have worked with Lustran have been astonished at the superior thermal stability of Lustran. Over a wide range of temperatures, it is possible to produce components with excellent uniformity in color and physical properties . . . performance not always achieved with other styrene polymers. With Lustran you can achieve consistent color control even in softest pastels. It can be molded and extruded in standard equipment. Sheets of Lustran can be formed, fabricated, and decorated using conventional techniques.

Can you capitalize on this development now? Lustran is now available from interim production facilities which can meet anticipated commercial requirements. A fifty million pound plant is now under construction. It will be in operation the latter part of 1961. With the addition of the Lustran family of plastics to our familiar Lustrex styrene molding materials, Monsanto now supplies the broadest spectrum of styrene based materials.

An extensive program has been set up to acquaint plastics converters with the unique capabilities and business building opportunities of Lustran. Plastics converters are invited to contact the nearest Monsanto sales office for more information. Designers and manufacturers are invited to write for current data and progress reports to Monsanto Chemical Company, Plastics Division, Dept. 803, Springfield 2, Massachusetts.

LUSTRAN, LUSTREX: Reg. U. S. Pat. Off.

MONSANTO INNOVATOR IN **PLASTICS**

Plastics Applications

For more information check Readers' Service Card (p. 83)

Injection molded parts of self-seating faucet.

Acetal Faucet Parts

Delrin acetal resin is being used for parts formerly made of brass in the internal cartridge mechanism of a self-seating faucet produced by Kel-Win Manufacturing Co. Four parts of the mechanism are injection molded from the Du Pont resin. According to company officials, the use of the thermoplastic has resulted in considerable cost savings.

Performance improvements made possible by the use of Delrin include freedom from corrosion and deposits from hard water. The insulating properties of Delrin tend to keep faucet handles from becoming hot.

Readers' Service Item 41

Molded Screws and Nuts

Pan-Pro Plastics is molding ¼-20 screws and nuts, designed for use in missiles and rockets, from a phenolic-impregnated glass fiber material. The screws and nuts are molded of Trevarno F-120, a product of Coast Manufacturing and Supply Co. Threads are reported to hold up well under continuous use.

Readers' Service Item 42

Automatic Lubrication System

An automatic lubrication system for cars and trucks, designed by the engineering division, Walker Manufacturing Co., uses Spencer Chemical Co.'s nylon 6 for several of its component parts. The system meters lubricant and delivers it under constant pressure to each lubrication point.

A lubricant reservoir feeds an integral pump which, automatically activated by engine oil pressure, feeds lubricant through manifolds to individual injectors. Nylon 6 was used for the translucent lubricant reservoir and for plugs and threaded sleeve fittings. Other grades of Spencer nylon are utilized in the manifolds, meter holders, and tubing.

Readers' Service Item 43

Clear Shrinkable Tubing

ScotchTite, a vinyl heat-reactive tubing which shrinks under heat to provide a tight covering for symmetrical or gently contoured shapes, is now available as a transparent tubing. The material will be sold by Irvington division, Minnesota Mining and Manufacturing Co. in black as well as clear. It will shrink in four-eight minutes when exposed to temperatures of 300° F. In sizes to fit O.D.'s from $\frac{3}{64}$ inch to five inches, the tubing can be used for covering harness cables, condensers, coils, high voltage leads, and other items where a tight, abrasion and chemical resistant electrical insulating cover is required.

Readers' Service Item 44

En Garde, Paper!

Dyna-Foam, an extruded, low density, polystyrene foam, may soon be giving paper stiff, but flexible, competition. Extruded from expandable polystyrene beads by Dyna-Foam Corp., the material has good thermal insulating characteristics, resilience, grease resistance, waterproofness, and appearance. It is expected to find many product applications.

One of the first applications is Flex-Pak, a cushioning material which not only protects products during shipping, but because of its light weight, will help reduce shipping costs. Inasmuch as it is non-abrasive, chemically inert, and non-dusting, it can be used for packaging highly polished products. It may also be used for foods. It is available in thicknesses of 10, 20, and 30 mils, sheets or rolls, in corrugated and pebble finished.

Dyna-Foam's lustrous, pearl-like appearance suggest it for use as gift wrapping, disposable tableware, and display materials. It takes flexographic, rotogravure, and silk screen inks, and lends itself to gluing or lamination to paper, aluminum foil, and other plastics. Dyna-Foam can be heat sealed, and slitting, die cutting, and sheeting can be accomplished on standard equipment.

Readers' Service Item 45

Polyester Resin Pipe

An isophthalic resin is being used for fiberglass-reinforced, corrosion service pipe, reported to have overcome many previous temperature and chemical limitations of plastic pipe. The pipe is fabricated by Reflin Co. from Dion-Iso DR-661 resin supplied by Chemical Process Co.

Reflin pipe is claimed to operate satisfactorily in continuous duty up to 350° F. According to the company, it will have greater fatigue resistance and durability, higher strength, and better chemical and physical properties than comparable glass-polyester pipe.

It is available in O.D. sizes of 4-, 6-, 8-, 10-, and 12-inches.

Readers' Service Item 46

Paint Roller

Triga-Rolla, a paint roller that ejects sleeves automatically, has been introduced by Rollers by Baker, Inc. A built-in sleeve ejector permits sleeves to slide off at the pull of a trigger.

All moving parts of Triga-Rolla are made of Marlex linear polyethylene, a product of Phillips Chemical Co. The use of polyethylene is designed to help eliminate paint streaking and to protect the metal frame from rust and corrosion. The roller is claimed to have passed practical tests with oil, acrylic, casein, PVA, enamel, alkyd, and vinyl based paints.

The Triga-Rolla.

Readers' Service Item 47

Polyurethane Rubber-Metal Bond

PA-820, a polyurethane adhesive for bonding rubber to metal, will cure at room temperature. It therefore can be recommended by Plastic Associates for such applications as attaching rubber feet to metal instrument cases or installing seals

THE AUTOMOTIVE INDUSTRY

WARMS UP TO BLOW MOLDING

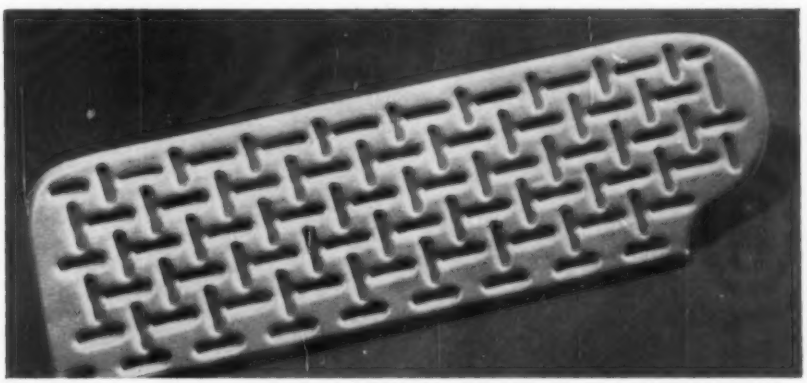
Keeping pace with design advances, the Chrysler Corporation investigated blow molding and found these heater ducts to be both functional and economical. Each is blow molded—in one piece—of BAKELITE Brand high density polyethylene. They're tough but light in weight. And though they are large and complex, the production rate is high.

These ducts prove that the blow molding of polyethylene reaches far beyond the realm of containers—that it is a practical, efficient and economical method for producing large or small, simple or complex parts.

The first consideration for the effective blow molding of such parts is the selection of the proper polyethylene. Union Carbide offers the greatest variety of polyethylenes available at one source—high, low or medium density, and copolymers. This means you are sure to find a formulation suited to your application.

What's more, you can call on Union Carbide for technical aid in blow molding it to best advantage. Union Carbide's experience in blow molding polyethylenes dates back almost as far as the technique itself, and has progressed as rapidly.

Remember, for design advancements in plastics, you'll find the materials and the experience at Union Carbide Plastics Company. For information write **Dept. IB-105,** Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York. *In Canada:* Union Carbide Canada Limited, Toronto 12.



The heater ducts (left) were blow molded for the Chrysler Corporation by Woodall Industries, Detroit, Michigan. **Prototype blow-molded sun visor (above)** also by Woodall illustrates the design flexibility of blow molding for automotive applications.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

TENITE DEVELOPMENT LABORATORY
DOINGS AND FINDINGS

POLYPROPYLENE PRIMER

Stereoregular . . . stereoblock . . . amorphous . . . smectic . . . Hectic?

Stereoregular polypropylene, with neatly spiraling polymer chains, is basically what you get in commercial polypropylene plastic. The molecules can spiral either clockwise or counterclockwise (*d* or *l* configurations), but to the best of our knowledge one configuration is as good as the other. What *is* important is that the molecular corkscrews be regular so that one can snuggle closely to another. This arrangement results in high crystallinity and gives the plastic great stiffness and hardness.

Under certain conditions, *stereoregular* molecules may pass through what appears to be a state of low-order crystallinity sometimes referred to as **smectic.** It is a highly unstable state, easily eliminated by a little heat. Although fascinating to the polymer chemist, *smectic* polypropylene means little to the processor.

Commercial production of stereoregular polypropylene also produces minimal amounts of *amorphous* and *stereoblock* polypropylene. **Amorphous** molecules — unlike stereoregular — twist and turn erratically, making tight packing (good crystal formation) impossible. **Stereoblock** molecules, having alternate sections of clockwise and counterclockwise spirals, are intermediate between stereoregular and amorphous on the basis of crystallinity.

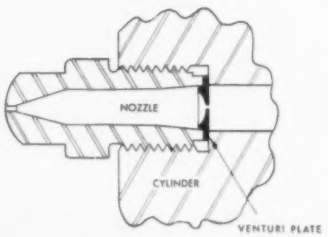
The true expert knows, however, that there's more to good polypropylene than elegant molecules. There's also the matter of special characteristics. The low ash content of Tenite Polypropylene, for instance, means low impurities and, consequently, good color. Since antioxidants added to the plastic are free of the degrading effects of ash, Tenite Polypropylene offers a high resistance to thermal breakdown. And for electrical applications, low-ash Tenite Polypropylene offers a low dissipation factor.

Word is getting around (it's true, too) that Tenite Polypropylene is an easy-to-mold plastic. Don't ask us why because we haven't the answer ourselves—just try it and we think you will be pleasantly surprised, particularly if you have an intricate or multiple-cavity mold.

THE UBIQUITOUS RESTRICTION

Injection molders have found that the naturally glossy finish of acetate, butyrate, and propionate plastic parts can be brought up to a truly mirror-like finish by dipping or spraying them with a solution of butyl acetate and acetone. These gentlemen have also found, however, that if a molded part has internal stresses, the solvent polish may act as a releasing agent and craze the surface.

The problem of internal stresses is easy to solve. A simple venturi plate—so useful for dispersing color when molding polyethylene—effectively minimizes that possibility in cellulosic parts. This orifice fits right behind the nozzle of the injection molding machine.



It has an opening 30 to 40 mils in diameter and a land of 30 mils. A land greater than 30 mils should be avoided since it might cause excessive pressure drop.

By restricting flow, the venturi plate allows cellulosic plastics to be injected at a higher melt temperature without stuffing the mold. The increase in melt temperature amounts to about 50°F.; this takes no account of additional heat due to friction at the plate. Besides permitting injection of a hotter melt, the plate also thoroughly mixes the melt. All these factors contribute to tough, attractive, and stress-free cellulosic plastic parts.

Our development laboratories are constantly working on better techniques for processing Tenite Polyethylene, Tenite Polypropylene, Tenite Butyrate, Tenite Acetate, and Tenite Propionate. For information or technical assistance, just contact your nearest Tenite representative or EASTMAN CHEMICAL PRODUCTS, INC., *Plastics Division,* KINGSPORT, TENN.

TENITE®
plastics by Eastman

Plastics Applications (Cont'd.)

on cabinet doors, procedures which otherwise require mechanical operations.

Supplied in two parts, PA-820 may in some instances be applied directly to the metal. If a primer is required, the metal is coated with PA-338, a clear epoxy that cures at room temperature.

Readers' Service Item 48

Polyethylene Display film

Continental Can Co. is marketing Conolex transparent linear polyethylene film which will adhere to any wet, smooth surface, such as window glass or mirrors. The film can be flexographic printed for display purposes. Static electricity acts as the adhesive.

Readers' Service Item 49

Urethane Coatings

Two urethane coatings, Poly-Form and Poly-Flex, have come into great use at the Beverly Hilton Hotel. Use of these coatings promises to reduce maintenance problems and costs greatly. Both coatings were developed by Formulabs, Inc.

Poly-Form's first use was on the heavily-used dance floors. Applied in less than 48 hours, the coating retains a mirror-like surface despite heavy traffic. Poly-Form has also been used to coat the barbecue ovens in the hotel's restaurant. Despite internal temperatures of 410° F. and heavy smoke, this white coating has not blistered or loosened. Black Poly-Form has been applied to more than 6,000 feet of balcony railing.

A special modification of Poly-Form, Poly-Flex has been applied to the Hilton's outdoor chairs and lounges.

Readers' Service Item 50

Mylar-Clad Steel Tape

A steel tape blade coated with Mylar is reported to outwear regular steel blades 3:1. Manufactured by Stanley Tools, the tape shows resistance to abrasion as well as to most solvents, alkalies, and acids. The markings, black on yellow for greatest visibility, will not wear off.

Rules are offered in six sizes: in 6, 8, 10, and 12 foot lengths with ½-inch wide blades, and 10 and 12 foot lengths with ¾-inch wide blades.

Readers' Service Item 51

Exploring Fabrication Techniques
(*Cont'd. from page 61*)

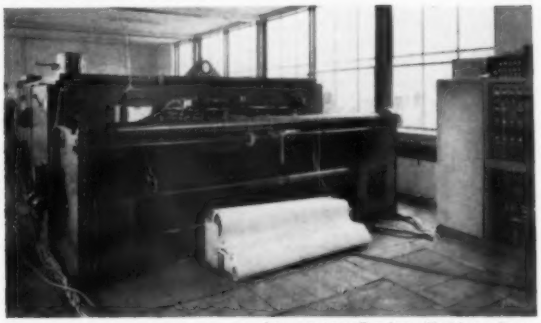


photo courtesy: Bruckner Machinery Corp.

Stenter-frame machine.

machine and transverse direction ratios are about equal.

As mentioned earlier, Bruckner Machinery Corp. has collaborated with me by running and recording these tests. This company has been supplying stenter-frames to the fabric industry, and has recently redesigned its line for plastics applications. The machine shown in the photo and diagram is adapted for polystyrene, and consists of four adjustment points for width control (one each at the entry and delivery ends, and two at the mid-section), plus an oven divided into three chambers (each supplied with independent temperature controls). Hot air is recirculated to heat the web. Web speeds are adjustable from 0 - 90 ft./ min. For the reported tests, the machine was run at 33 ft./-min. at a stretch ratio of 3:1. —THE END

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New Literature

For more information check Readers' Service Card (p. 83)

"Pneu Vac." Bulletin 18-G. Sprout Waldron & Co., Inc. 4 pages. Advantages, construction details, applications, and specifications of this line of negative pressure pneumatic conveyors are presented.

Readers' Service Item 61

"Catalog 202." Warminster Fiberglass Co. 2 pages. The bulletin outlines strength, corrosion resistance, and dielectric properties of fiberglass components, the types of parts which are produced through the company's laminating and molding processes, and the design assistance which it renders.

Readers' Service Item 62

"High Vacuum Gages." Bulletin 9-1. Consolidated Vacuum Corp. 32 pages. The pamphlet discusses absolute manometers, thermal gages, ionization gages, a combination thermal-ionization gage, magnetic amplifier controllers, and sensing tubes for vacuum applications. Design details, structural data, and features are clearly presented.

Readers' Service Item 63

"Perforating, Slitting, and Blanking." Catalog 60. Perforating Industries, Inc. 20 pages. Custom perforating, slitting. and blanking on all types of flexible material, rigid sheets, and foams, are provided by the company. Included are suggested applications, materials, specifications, and patterns.

Readers' Service Item 64

"Marlex Polyethylenes, Ethylene Copolymers, and Tailored Resins." Phillips Chemical Co. 4 pages. Typical properties and applications of high, medium, and low density resins.

Readers' Service Item 65

"Isochemrez 400 Series." Isochem Resins Co. 3 pages. Outlines uses, fillers, properties, etc., of this series of general purpose epoxy resins. Includes directions for use and choosing a hardener.

Readers' Service Item 66

"Rubber Red Book." 13th Edition. Palmerton Publishing Co., Inc., 101 W. 31st St., New York 1, N. Y. Paper, 8¼ by 11 inches, 813 $15.00.

This annual register includes listings of rubber manufacturers, machinery and equipment, chemicals and compounding materials, synthetic and natural rubbers, scrap rubber and plastics, latices, reclaimed rubber, who's who, etc. As an improvement over the preceding edition, names and addresses of suppliers have been grouped into a complete alphabetical section.

Readers' Service Item 67

"Cadco Plastics Catalog and Price List." Cadillac Plastic and Chemical Co. 63 pages. Enables cost and property comparison of acetate, acrylic, butyrate, Delrin, Implex, Kel-F, Mylar, nylon, phenolic, polyethylene, polystyrene, high impact styrene, Teflon, and vinyl in cast, extruded, molded, and laminated shapes. Lists available sizes, weights, color ranges, textures, specifications, grades, and prices.

Readers' Service Item 68

"Move Up to Bulk Handling." Bulletin #532. Dracco Division of Fuller Co. 6 pages. Bulk handling with penumatic conveying of pelletized plastics can be much more economical than bag handling in large volume plants. Examples of pneumatic conveyor systems are shown.

Readers' Service Item 69

"Pneumatic Pressure and Temperature Controllers." Catalog J-C. OPW-Jordan Corp. 6 pages. Available for controlling pressures up to 10,000 psi. and temperatures from —125° to 1000° F. Uses, specifications, features. Analysis of measuring elements.

Readers' Service Item 70

"Monmouth Fiberglass Reinforced Plastic Tanks." Monmouth Fiberglass Industries, Inc. 2 pages. The company custom designs tanks for individual conditions of corrosion and stress. Many resins and reinforcements are available.

Readers' Service Item 71

"Fasteners for Metals and Plastics." My-T-Grip Mfg. Co., Inc. 16 pages. Flush, shoulder, and self-staking fasteners are illustrated in half tones and plan and dimension drawings. Specifications and holding characteristics are included, as are specifications on a line of studs.

Readers' Service Item 72

"New Kralastic MH Engineering and Molding Data." Naugatuck Chemical Division, U. S. Rubber Co. 20 pages. This ABS is noted for easy moldability and good appearance. It is recommended for injection molding, vacuum forming, and extrusion. Physical property tabulations, photographs of applications, and processing directions are provided.

Readers' Service Item 73

"FS Steelset Diamond Impregnated Products." Catalog DG 395. Fish-Shurman Corp. 38 pages. Specifications and dimension drawings of a line of metal-bonded diamond tools. Equipment and operating recommendations. Suggestions for wheel selection and use.

Readers' Service Item 74

"Use of Asbestos Shorts in Plastics." Carey-Canadian Mines, Ltd. 3 pages. Asbestos may be used in cold molded, thermoplastic, and thermosetting materials. Advantages which asbestos contributes to resin properties are outlined.

Readers' Service Item 75

"Electric Heating Elements." Bulletin BHA. Acra Electric Corp. 4 pages. Acrawatt Thin Band electric heaters can be used on a wide range of circular containers. The bulletin illustrates, diagrams, and describes several types and sizes.

Readers' Service Item 76

"Conversion Factors." Precision Equipment Co. 1 page. This wall chart is laid out in columns showing multiplication to obtain equivalent values. For example, multiply atmospheres by 1.058 to obtain tons per square foot.

Readers' Service Item 77

"High-Density Tenite Polyethylene." Materials Bulletin 3. Eastman Chemical Products, Inc. 4 pages. Properties and uses of the 3300 and 3400 series of Tenite polyethylene are presented. These resins can be used for molding, extrusion blowing, film extrusion, coating, and filament production.

Readers' Service Item 78

"The Profitable Present and the Fabulous Future of Urethane Foams." Mobay Chemical Co. 24 pages. A combination pictorial progress report and designer's fact file on industrial and commercial applications for urethane foams. Performance data relevant to several application areas.

Readers' Service Item 79

Patent Digest

Materials

Vinyl Halide Polymer Compositions Containing Polymerization Products of Methyl Methacrylate with a Butadiene-Styrene Copolymer. No. 2,943,074. S. S. Feuer, Feasterville, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

Prevention of Development of Color by Iron Compounds in Plastics. No. 2,943,-070. A. C. Hecker, Richmond Hill, and M. W. Pollock, New York, N. Y. (to Argus Chemical Corp.).

Polyamides from Oxamic Acids. No. 2,945,011. J. R. Caldwell and R. Gilkey, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

Equipment

Apparatus for Stretching Plastic. No. 2,-933,759. P. Startzell, Greensburg, Pa. (to Pittsburgh Plate Glass Co., Allegheny County, Pa.).

Process and Apparatus for Obtaining Rubber or Plastic Sheeting of Uniform Thickness at High Temperatures. No. 2,-933,760. E. J. von der Heide, Hudson, O.

Barrel Type Extruders. No. 2,933,762. H. F. Pumphrey, Solihull, England (to Dunlop Rubber Co. Ltd., London, England).

Plastic Metering and Dispensing Apparatus. No. 2,933,763. J. A. Alesi, Los Angeles, Calif.

Method of and Apparatus for Molding and Curing Plastic Material. No. 2,937,-401. H. Amos, Burton, Wash. (to Pastushing Aviation Corp., Los Angeles, Calif.).

Apparatus for Producing Film. No. 2,-937,402. R. F. Pierce, Terre Haute, Ind. (to Union Carbide Corp.).

Method of and Portable Apparatus for Depositing Reinforced Plastic. No. 2,933,-125. D. F. Anderson, Camden, Maine (to Canadian Ingersoll-Rand Co., Ltd., Montreal, Quebec, Canada).

Manufacture of Pellets or Granular Material. No. 2,938,230. C. L. Sainty, Hassocks, England (to Structural Concrete Components Ltd., Hassocks, England).

Plastic Injection Molding Machines. No. 2,937,405. L. J. Berggren, A. S. Dorosz, and J. F. Leahy, Beverly, Mass. (to United Shoe Machinery Corp., Flemington, N. J. and Boston, Mass.).

Liquid Plastic Lining Machine. No. 2,-937,404. E. A. Wilckens, W. C. Rainer, and J. G. Germak, Baltimore, and J. P. Hamilton, Glen Burnie, and E. M. Redding, Baltimore, Md. (to Crown Cork & Seal Co., Inc., Baltimore, Md.).

Plastic Extrusion Die. No. 2,938,231. R. E. Lowey, Jr., Cuyahoga Falls, O. (to Blaw-Knox Co., Pittsburgh, Pa.).

Combined Injection and Compression Molding. No. 2,938,232. F. A. Martin, Akron, O. (to Hoover Co., N. Canton, O.).

Pipe Ejector-Pull Out. No. 2,940,119. L. Perrault, Tulsa, Okla. (to H. D. Boggs Co., Ltd., Omaha, Neb.).

Apparatus for Forming Hollow Plastic Containers with Pre-Molded Finished Neck Sections. No. 2,940,120. M. J. Grebowiec, Kansas City, Mo. (to Injection Molding Co., Kansas City, Mo.).

Apparatus for Forming Hollow Plastic Articles. No. 2,940,121. O. B. Sherman, W. Orange, N. J. (to Owens-Illinois Glass Co.).

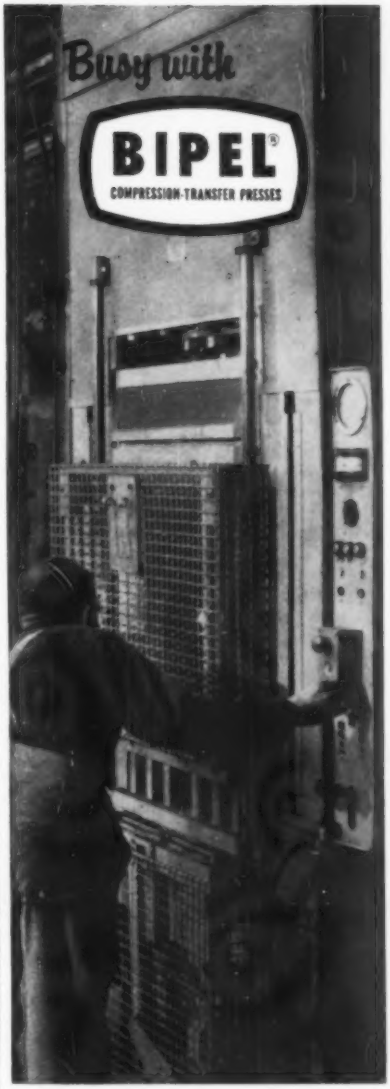
Mixing Machine. No. 2,941,239. H. O. Theysohn, Hannover-Laatzen, Germany Paul Troester Maschinenfabrik, Hannover-Wulfel, Germany).

Apparatus for Extruding Tubing of Polytetrafluoroethylene. No. 2,941,240. E. C. Distler, Jenkintown, Pa. (to Jennings Machine Corp., Philadelphia, Pa.).

Extrusion Press for Production of Sheet-like or Tubular Structures from Thermoplastic Synthetic Compositions. No. 2,942,-294. H. Reifenhauser, Troisdorf-Cologne, Germany (to Reifenhauser K.G., Troisdorf-Cologne, Germany).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.

—The Editor



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Article Abstracts

Materials

"Polyether-Based Flexible Urethane Foams," E. A. Packer and J. F. Wood, RUBBER & PLASTICS AGE, 41, 10, 1174 (Oct. 1960).

Discussion of the chemistry of urethanes, preparation of foams, and applications.

"The Effect of Water on the Bursting Strength of Rigid PVC Pipes," A. K. Van der Vegt, KUNSTSTOFFE, 50, 10, 547 (Oct. 1960).

Moisture absorption and creep strength curves were determined for a number of rigid PVC pipes at 60° C., and the effect of previous storage in water investigated. It was found that moisture absorption cannot be taken as a criterion on pipe behavior.

"Raw Materials for Fibre Reinforced Plastics," M. Hagedorn, KUNSTSTOFFE, 50, 10, 547 (Oct. 1960).

A continuation of the report on the 1960 meeting of the SPI Reinforced Plastics Division.

"Mechanical Behavior of Glass Fibre Reinforced Unsaturated Polyester When Uniaxially Stressed and in Water," F. J. Frank, KUNSTSTOFFE, 50, 10, 550 (Oct. 1960).

Results of tests with pure polyester and glass-reinforced polyester specimens to determine tensile strengths, E-modulus, and creep behavior, both in the dry state and after immersion in water.

"Effect of Melting Conditions on the Crystallization of Polypropylene," J Majer, KUNSTSTOFFE, 50, 10, 565 (Oct. 1960).

The temperature necessary to produce a melt completely free from nuclei to 140° C. was found to be 235-240° C.

"Emulsion Polymerization Using Polyacryolein Sulfurous Acid Solution as Emulsifier," H. Cheydron, KUNSTSTOFFE, 50, 10, 568 (Oct. 1960).

A new type of macromolecular emulsifying agent is described.

"Thoughts on the Problems of Plastics Testing," R. Reichherzer, PLASTVERARBEITER, 11, 6, 257 (June 1960).

It is rarely possible for the manufacturer to get test data on materials that are strictly comparable with standards. The author shows by examples of hardness, tensile, and impact tests how factors like dimensions, deformation time and energy affect results. (In German.)

"Problems in the Production of Unsaturated Polyesters," V. Zvonar and A. Sternschuss, PLASTE U. KAUTSCHUK, 7, 5, (May 1960).

Discussion of the mechanism of reactions occurring during the formation of resins based on unsaturated polyesters. The heats associated with the addition of anhydrides to glycol are given. The effect of isomerization of maleic acid to fumaric acid on the reactivity of the resins is examined, as well as the properties of finished products. (In German.)

"Degradation Processes in Macromolecular Chemistry. I. Hydrolytic Degradation," J. M. Gomez Fatou, REVISTA PLASTICOS, 11, 64, 223 (June-July 1960).

Hydrolytic degradation processes and their quantitative evaluation are reviewed by the example of hydrolysis of natural and synthetic polymers (e.g., cellulose, starch, polyamides, and polyesters) and hydrolysis without chain scission, particularly in the case of polyvinyl acetate. (In Spanish.)

"Polyolefins—Recent Italian Chemical Engineering Developments," P. Giustiniani, MATERIE PLASTICHE, 26, 5, 389 (May 1960).

Review of recent Italian achievements in the field of polyolefin research and development. (In Italian.)

"Cellulose triacetate as Raw Material for Varnishes and Plastics. IV. Further Studies on Plasticizers for Cellulose Triacetate," W. Thummler and K. Thinius, PLASTE U. KAUTSCHUK, 7, 5, 215; 7, 6, 294 (May and June 1960).

Tests on the efficiencies of a number of substances as plasticizers for cellulose triacetate to produce compounds for calendered sheet and injection moldings are described. Results indicate that suitable plasticizers barely make it possible to obtain thermoplastic compounds from the triacetate that could perhaps compete with the secondary acetate as to mechanical properties. (In German.)

"Rust Protection by Metallized Surface-Active Pigments," H. Brandt, PLASTE U. KAUTSCHUK 7, 5, 259 (May 1960).

Tests are described with a new finish to protect iron surfaces against rust which uses so-called active capillary pigments (AK Pigments) made from silica gel saturated with ferric or ferrous chloride solutions. (In German.)

"Enzyme Hydrolysis of Polycaprolactam. II," H. Harnauer, PLASTE U. KAUTSCHUK, 5, 7, 239 (May 1960).

The action of various digestion enzymes and body fluids on polycaprolactam sutures and polyamid block material was investigated. It appears that sutures of synthetic materials will also be absorbed in the living organism under appropriate conditions. (In German.)

"Recent Experience with Polycarbonates," H. W. Streib, BRIT. PLASTICS, 33,9. 406 (Sept. 1960).

The salient mechanical, thermal, permeability, and electrical properties are mentioned, as well as techniques in processing and finishing.

"The Swelling and Fracture of Polythene Melts," D. L. T. Beynon and B. S. Glyde, BRIT. PLASTICS, 33, 9, 414 (Sept. 1960).

Based on test results, it is shown that extrusion processes carried out at flow rates well below the critical point, results in swelling decreasing at increasing temperature.

"On the Alkylation of Phenolic with Isobutylene," A. Heimel, KUNSTSTOFFE, 50, 9, 514 (Sept. 1960).

A brief review of the subject.

"High Frequency Welding Auxiliaries," B. Kowald, KUNSTSTOFFE, 50, 10, 593 (Oct. 1960).

This subject is discussed in detail for the first survey of this modern field of application.

"Dropping Device for Tracking Current Tests," H. Suhr, KUNSTSTOFFE, 50, 10, 595 (Oct. 1960).

A new dropper with a Teflon nozzle is described.

"Problems of Short-Run Production," Roy Wilson, CANADIAN PLASTICS, p. 44 (Nov. 1960).

Automatic compression molding is shown to simplify short-run production. Discussed are such factors as molds, tool quotations, equipment, molded parts, cycle times, feed assembly, method efficiency, cost comparison, labor costs, capital investment costs, and the need for redesigning.

"Effects of Controlled Wattage on Extruder Barrel Temperatures," R. H. Ramsey, SPE J., 16, 10, 1111 (Oct. 1960).

A system for controlling heater wattage on extruder barrels within 1°F.

Applications

"Developments in Blow Molded Containers," T. W. Mullen, WESTERN PLASTICS, 7, 9, 21 (Sept. 1960).

A short discussion of equipment, raw materials, and container applications.

"Plastics Reservoirs for Water Storage," H. R. Spice, PLASTICS (LONDON), 25, 275, 356 (Sept. 1960).

Use of black polyethylene sheet in trenches and reservoirs.

"Standardization and Pipes," F. W. R. Wijbrans, PLASTICS (LONDON), 25, 275, 358 (Sept. 1960).

Three discussions which will be presented at the ISO Committee on Plastics in November.

"Attractive Blister Pak by Precision Packaging," K. H. Kiteley, CANAD. PLASTICS, pg. 52 (Oct. 1960).

A short item on how Precision Packaging Co. designs and produces its packages.

"Plastics for Atom-Smashers," J. O. Turner, RUBBER & PLASTICS AGE, 41, 9, 1034 (Sept. 1960).

A brief discussion of acrylic usages, fire hazards, high-strength materials, laminates, and epoxy resins.

"Preparation and Application of Furane Resins from Furfuryl Alcohol," H. Kaesmacher, KUNSTSTOFF-RUNDSCHAU, 7, 6, 265 (June 1960).

This final installment of a three-part article on furane resins deals with tests on the suitability of furfuryl alcohol resins as raw materials for varnishes and as Casting resins. (In German.)

"The Properties of Montivel as Packaging Material," L. Lucchetti and F. Protospataro, MATERIE PLASTICHE, 26, 5, 430 (May 1960).

The properties for packaging applications of Montivel—polyethylene terephthalate film—and its laminates, especially the Montivel/Moplefan (polypropylene film) product, are discussed. (In Italian.)

General

"Report on the Interpack," KUNSTSTOFF-RUNDSCHAU, 7, 6, 277 (June 1960).

Equipment and various applications, chiefly German, shown at the Interpack 1960 Exhibition in Dusseldorf are described in some detail. (In German.)

"The Biological Deterioration of Plastics," H. J. Hueck, PLASTICS (LONDON), 25, 276, 419 (Oct. 1960).

A picture of biological deterioration of plastics as seen by a biologist, and covering microbiological deterioration, infestation by insects, and infestation by rodents.

"Problems Ahead for Oil Industry as it Moves into Plastics," John Mellecker, CHEM. PROCESSING, 23, 10, 31 (Oct. 1960).

The need for sound marketing strategy, strong technical service, and creative research in the plastics business are stressed.

"Mr. Manufacturer: This Article Could Mean Increased Profit for You," James Wallace, CANAD. PLASTICS, pg. 41 (Oct. 1960).

A brief discussion of custom versus captive molding.

"Plastics in Europe: Germany," W. Mauss, PLASTICS (LONDON), 25, 276, 383 (Oct. 1960).

A review of the current status of plastics in Germany.

(Continued on page 80)

Requests for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"Applied Plastics"
The Scientific Press, Ltd.
11 Gloucester Road
London, S.W. 7, England

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
243 Elizabeth Street, Suite 406,
Sydney, N.S.W., Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London, S.E.1., England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Gummi & Asbest"
A. W. Gentner-Verlag
Forsterstrasse 131, Postfach 688
Stuttgart, W. Germany

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Jornal de Plasticos"
Av. Rio Branco, 211
Sao Paulo, Brazil

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Kunststoff Zerater"
Kettenhofweg 111
Frankfurt A.M., Germany

"Materials in Design Engineering"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W. 7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.1.
England

"Plastics Age News"
Plastics Age Co., Ltd.
34 Higashi-Shimizu-machi
Minami-ku
Osaka, Japan

"Plastics Industry"
130 Clarendon St.
Boston 16, Mass.

"Plastics Industry News"
Institute of Polymer Industry, Inc.
Mitsubishi-Maka- 6-1
Marunouchi, Chiyoda-ku
Tokyo, Japan

"Plastics World"
Cleworth Publishing Co., Inc.
1 River Road, Cos Cob, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Rudolf Zechner Verlag, G.m.b.H.
Speyer/Rhein, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Practical Plastics"
Box 4850
G.P.O. Sydney, Australia

"Progressive Plastics"
481 University Avenue
Toronto 2, Canada

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
65 Prospect St., Stamford, Conn.

"Spectator"
Published by New England Chapter
Society of Plastics Engineers, Inc.
Somers, Conn.

"Transactions of the Plastics Institute"
6 Mandeville Place, London W.1.
England

"Western Plastics"
Western Business Publications
274 Brannan Street
San Francisco 7, Calif.

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CALENDAR of COMING EVENTS

February 20-23
Technical Association of the Pulp and Paper Industry. Annual Meeting. Hotel Commodore, New York, N. Y.

February 26-March 1
American Institute of Chemical Engineers. Petrochemical and Refining Exposition. Municipal Auditorium, New Orleans, La.

March 15-16
American Society of Tool and Manufacturing Engineers and SPE. Seminar on Plastics for Tooling. Hotel Statler, Detroit, Mich.

March 21-30
American Chemical Society. 138th National Meeting. St. Louis, Mo.

April 20-21
SPI Eighteenth Annual Western Section Conference. Hotel del Coronado, Coronado, Calif.

April 25
SPE Central Indiana Section RETEC. Plastics for Tooling. Indianapolis, Ind.

May 9
SPE Detroit Section RETEC. Plastics in the Automotive Industry. Detroit, Mich.

May 22
ASME Design Engineering Conference and Show. Cobo Hall, Detroit, Mich.

June 5-9
SPI National Plastics Conference. Commodore Hotel, New York, N. Y.

June 5-9
SPI Ninth National Plastics Exposition. Coliseum, New York, N. Y.

June 11-15
ASME Summer Annual Meeting. Statler Hilton, Detroit, Mich.

June 16-25
Europlastic 61. International Plastics Exhibition. Palais des Floralies, Ghent, Belgium.

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Article Abstracts (Cont'd.)

General

"The Problem of Labeling Commonly Used Goods within the Common Market," P. Burin, IND. PLASTIQUES MOD., 12, 7, 16 (Aug.-Sept. 1960).

The problem of informing the general public on the essential properties of commonly-used plastics goods available commercially has been occupying the countries of the Common Market of Europe. In this article, Dutch and French proposals so far submitted are discussed. (In French.)

"The Market for Plastics Materials in Italy in 1959," G. Moretti, MATERIE PLASTICHE, 24, 7, 621 (July 1960).

Details and figures are presented on Italy's output, consumption, imports and exports of plastics materials in 1959, developments being compared with those in the United States and Germany. (In Italian.)

"1959 Golden Compasses-Award and Plastics," M. Parducci, MATERIE PLASTICHE, 24, 6, 597 (June 1960).

Description of the four products made of plastics or employing plastics in their construction (including the Fiat Nuova 500 automobile) which were awarded the Golden Compasses for industrial design in 1959, as well as of 12 other items which received honorable mention. (In Italian.)

Domestic Production and Sales of Plastics and Resin Material, August and September, 1960

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of August and September, 1960. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	August, 1960		September, 1960	
	Production	Sales	Production	Sales
Cellulose Plastics:				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,429,323	1,479,692	1,787,850	1,906,694
Sheets, 0.003 gage and over	1,745,549	1,771,676	2,185,247	2,159,393
All other sheets, rods, and tubes (including other cellulose plastics)	668,796	867,870	789,645	899,035
Molding and extrusion materials (including other cellulose plastics)	7,729,779	7,559,979	7,655,215	7,647,297
Nitrocellulose sheets, rods, and tubes	187,858	103,544	50,556	110,310
TOTAL	11,761,305	11,782,761	12,468,513	12,722,729
Phenolic and Other Tar-Acid Resins:				
Molding materials	15,369,519	15,745,388	15,718,142	22,046,601
Bonding and adhesive resins for—				
Laminating (except plywood)	6,036,711	3,965,432	6,773,935	4,552,434
Coated and bonded abrasives	1,303,610	1,095,691	1,202,395	1,379,231
Friction materials (brake linings, clutch facings, and similar materials)	895,849	924,626	1,236,492	1,041,634
Thermal insulation (fiber glass, rock wool)	4,330,574	4,399,473	4,115,001	4,283,018
Plywood	5,456,995	3,959,468	5,128,202	4,662,630
All other bonding and adhesive uses	5,530,014	6,049,629	6,422,650	6,736,095
Protective-coating resins unmodified and modified except by rosin	2,026,902	1,635,293	1,933,941	1,773,835
Resins for all other uses	3,138,125	3,005,345	3,282,373	2,963,791
TOTAL	44,088,299	40,780,345	45,813,131	49,439,269
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,693,244	2,465,502	2,137,194	2,281,256
Paper-treating and paper-coating resins	2,373,474	2,191,959	2,542,365	2,294,753
Bonding and adhesive resins for—				
Laminating	3,060,598	2,987,906	3,723,823	2,410,909
Plywood	8,388,738	7,894,341	7,813,194	7,461,671
All other bonding and adhesive uses	2,312,254	2,670,621	2,594,820	2,788,385
Protective-coating resins, straight and modified	2,912,800	2,282,576	2,779,779	2,325,879
Resins for all other uses, including molding	8,889,606	9,247,126	10,224,626	10,291,232
TOTAL	30,630,714	29,739,931	31,815,801	29,854,085
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	23,320,084	19,649,534	23,771,000	19,059,625
All other	31,716,658	24,785,695	25,294,812	22,858,383
Protective-coatings	5,595,190	5,048,532	5,319,772	5,635,827
Textile and paper treating and coating resins	6,459,940	4,822,567	5,666,824	4,214,219
All other uses	14,713,957	21,213,786	12,325,281	18,310,446
TOTAL	81,805,829	75,520,114	72,377,689	70,078,500
Vinyl and Vinyl Chloride Resins:				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		9,005,276		7,661,716
Sheeting (resin content)		9,971,251		11,094,775
Molding and extrusion (resin content)		26,087,212		25,115,747
Flooring (resin content)		7,021,083		5,570,849
Protective coating (resin content)		13,739,116		14,215,240
All other uses (resin content)		3,874,121		3,922,286
All other vinyl resins for—		12,383,030		9,510,102
Adhesives (resin content)				
Protective coatings (resin content)		5,539,225		4,883,649
All other uses (resin content)		2,536,038		2,341,568
TOTAL		9,560,021		11,036,105
Coumarone-Indene and Petroleum Polymer Resins	94,675,340	99,726,373	96,835,073	95,352,037
Polyester Resins:				
For reinforced plastics	21,216,721	21,597,444	20,066,079	19,639,605
For all other uses	9,963,301	8,638,592	9,173,808	8,167,689
TOTAL	1,585,251	1,624,483	1,648,649	1,244,217
Polyethylene Resins:				
For film and sheeting	11,548,552	10,263,075	10,822,457	9,411,907
Molding materials		32,165,275		36,328,292
Extrusion materials		16,165,343		15,669,284
For all other uses		15,917,674		13,118,333
TOTAL		40,241,545		41,265,222
Epoxy Resins:	106,950,027	104,489,837	109,338,553[1]	106,381,131[2]
For protective coatings				
For all other uses		1,793,966		1,503,497
TOTAL		3,147,110		2,611,024
Silicone Resins	4,886,130	4,941,076	5,093,796	4,114,521
Miscellaneous Synthetic Plastics and Resin Materials	297,364	374,775	486,132	454,102
GRAND TOTALS	24,911,510	21,592,180	25,371,286	21,164,717
	432,771,791	420,807,911	430,488,510	418,612,603

[1] 17.6% produced by the low-pressure process.
[2] 13.9% produced by the low pressure process.
SOURCE: United States Tariff Commission, Chemical Division.

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